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MODERN METALS

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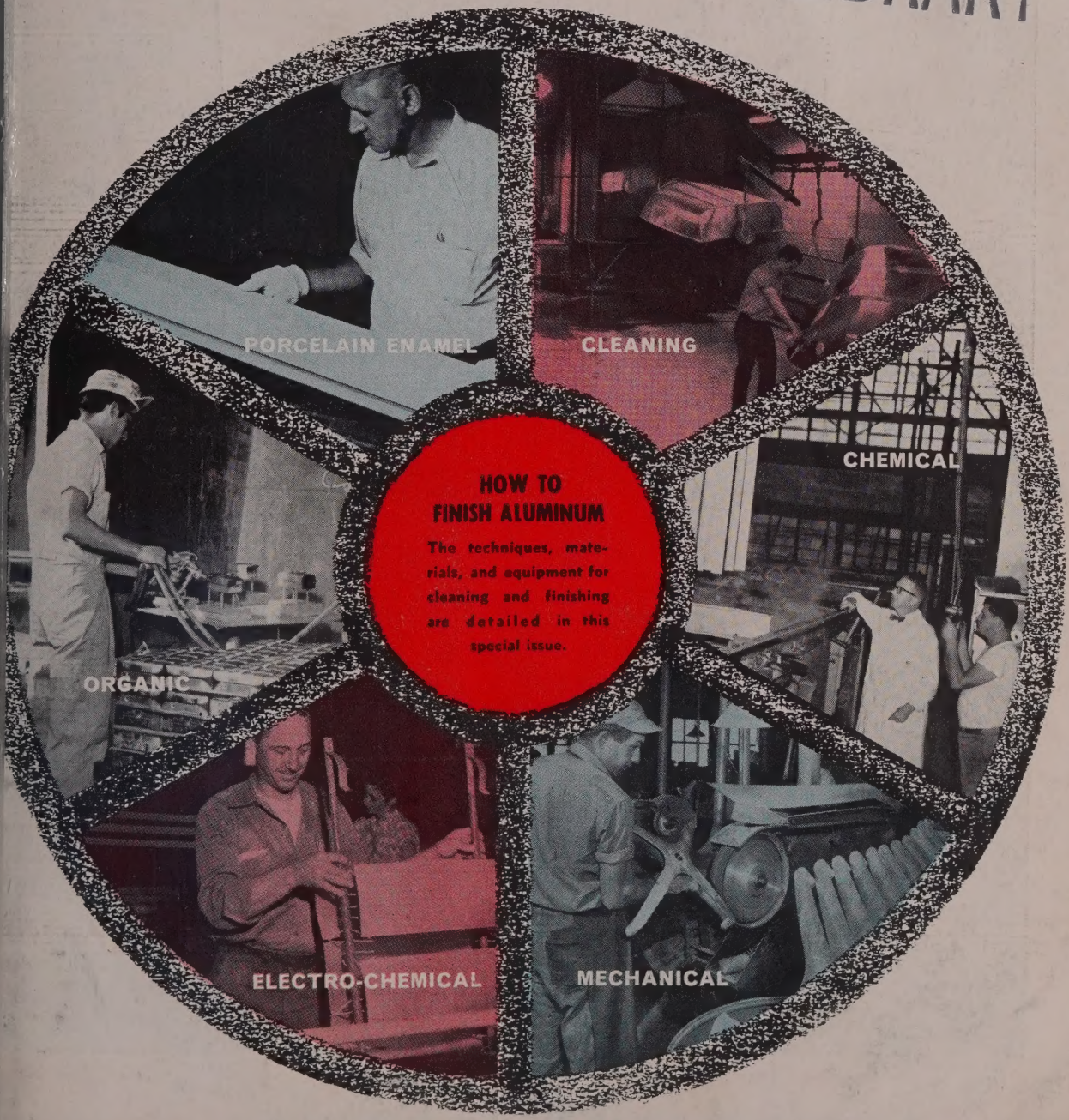

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The techniques, materials, and equipment for cleaning and finishing are detailed in this special issue.

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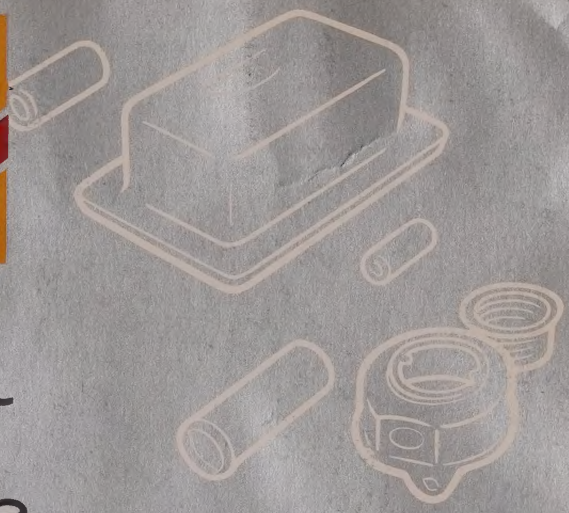

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ISC5

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How to select the right aluminum alloy for screw machining

Suitable Aluminum Alloys: Since aluminum can be cut at exceptionally high speeds and feeds, a high production rate is assured. The principal alloys used in automatic screw machines are 2011-T3, 2017-T4, 2024-T4, and 6061-T6.

2011-T3 Of these, 2011-T3 is considered superior. It has lead and bismuth added to speed machining, improve the finish of the machined part, and create a finely divided chip. This alloy is specifically recommended for a broad range of screw machine products.

2017-T4 Alloy 2017-T4 offers greater corrosion resistance and ductility than 2011-T3 and is often suggested for parts which require mechanical operations after machining. It is selected frequently for rivets and products requiring deep drilled holes.

2024-T4 The 2024-T4 alloy has higher mechanical properties than 2011-T3 or 2017-T4 and is widely used for aircraft fittings. Because of its relatively high shear strength, many rivets and threaded fasteners are made from it.

6061-T6 Although 6061-T6 has somewhat lesser mechanical properties and a lower machinability rating than the foregoing alloys, it has superior corrosion resistance and is more suitable for brazing, soldering and fusion welding. This alloy also gives a better finish when anodized. Tools for machining 6061-T6 require larger rake angles since the chips are less brittle and have a tendency to buildup on the cutting edge. The nonheat-treatable alloys such as 3003 and 5052 in their hard tempers are not as free-cutting as the above-mentioned heat-treated alloys, but they are readily cut with a large rake angle. To induce favorable chip formation, chip breakers or chip curlers are recommended for the cutting tool.

SPEEDS AND FEEDS

High machining speeds with moderate feeds and depth of cut are recommended for aluminum screw machine stock. Speeds of up to 700 surface feet per minute and more, with feeds up to about 0.020 inch and 0.250 inch depth of cut are customary.

COSTS

Keep in mind that aluminum must be compared on the basis of price per piece instead of price per pound when figuring material costs. Remember a pound of aluminum will yield three times as many pieces as a pound of most other metals.

CUTTING TOOL LUBRICANTS

The high rate of metal removal when automatic screw machining aluminum makes it desirable to use a high volume of low viscosity cutting fluid or lubricant under low pressure, carefully directed to hit the tool and work to carry away as much heat as possible. Lighter oils flow over the work more readily and thus can be expected to remove heat faster.

Mineral oils with a viscosity of not more than 100 seconds Saybolt Universal (at 100°F) are recommended. Water soluble oils also work well on machines where seepage of the lubricating oils can be controlled. Soluble oils have the advantage of removing heat faster than usual mineral oils.

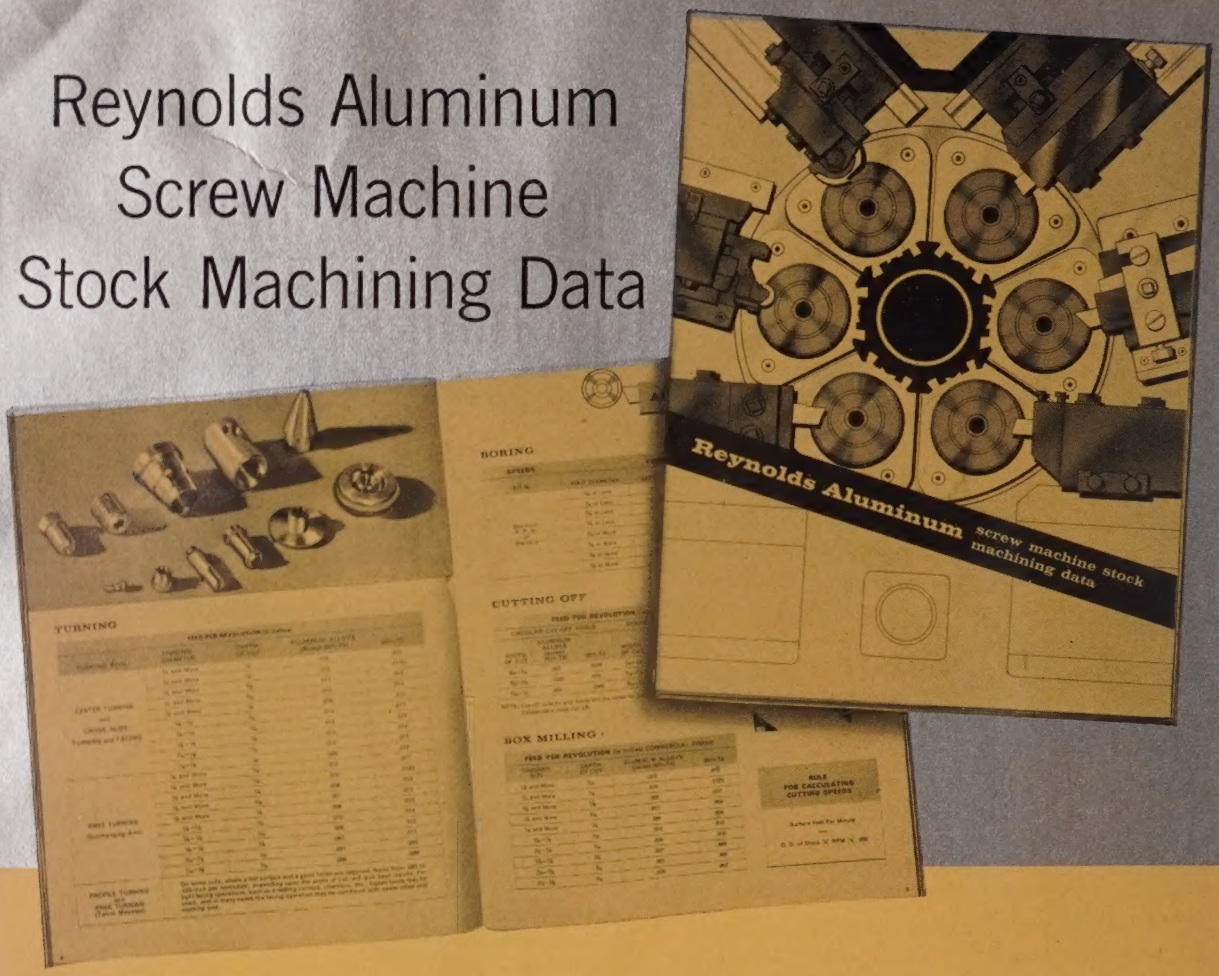
For exacting jobs, use oils especially designed for work with aluminum. They usually consist of a light mineral oil with 5-10 percent of fatty additions (such as oleic acid, lard oil, or neatsfoot oil) with a viscosity of 45-65 seconds Saybolt Universal at 100°F.

All aluminum alloys have good machinability but in the interest of efficiency it is desirable to design tools and specify cutting conditions tailored to each alloy.

And, to be sure you get the right aluminum—use Reynolds Aluminum

FREE booklet on Reynolds Aluminum Screw Machine Stock Machining Data—see next page. →

Reynolds Aluminum Screw Machine Stock Machining Data



Add to your Technical Library with this new informative booklet

This fact-packed 12-page booklet details the proper speeds and feeds for turning, forming, threading, cutting and knurling—plus tables, charts and illustrations. Invaluable for the engineer and metal worker.

For complete information, answers to your questions on aluminum, and the "Aluminum Screw Machine Stock Machining Data" booklet, contact your nearby Reynolds Distributor or write to the *Reynolds Metals Company, Box 2346-KL, Richmond 18, Virginia.*

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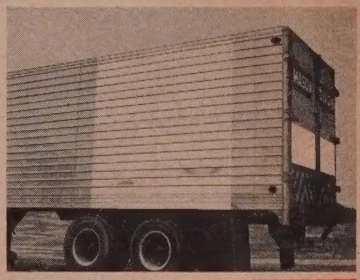
A Mason Dixon Truck-Trailer, panel coated for road testing with Egyptian Clear Coating CH-64 was brought in off the road after 16 months and 128,000 miles of rugged over-the-road service. (See trailer photo.) It was hosed down and immediately the Egyptian CH-64 coated panel stood out lustrous and smooth in startling contrast to the dull, spotted and pitted uncoated section. Note that the body surface shows two major dents. No loss of adhesion could be detected even though the coating was penetrated.

Frankly, the purpose in bringing the results of this test to your attention is to point out that coating Your Aluminum Product with Egyptian CH-64 will make it last longer . . . look better . . . sell faster . . . at a nominal cost.



Naturally you will want to test coat your product before making up your mind . . . Egyptian offers you this service free. Or, there may be a new product in the planning stage. Here detailed information on CH-64 can prove invaluable . . . either way Egyptian stands ready to help.

CLEAR COATING CH-64

developed in cooperation with
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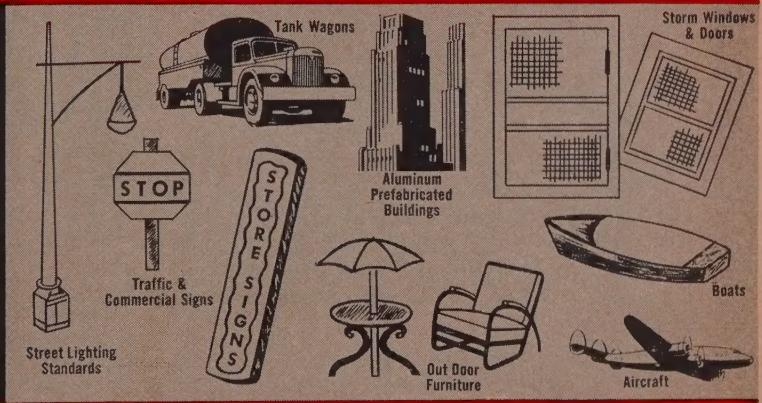

Seeking a sure fire plus-factor to build a greater market for your product? Then it's important that you get more information about Egyptian CH-64 right-away! Use Coupon or Your Company Letterhead.

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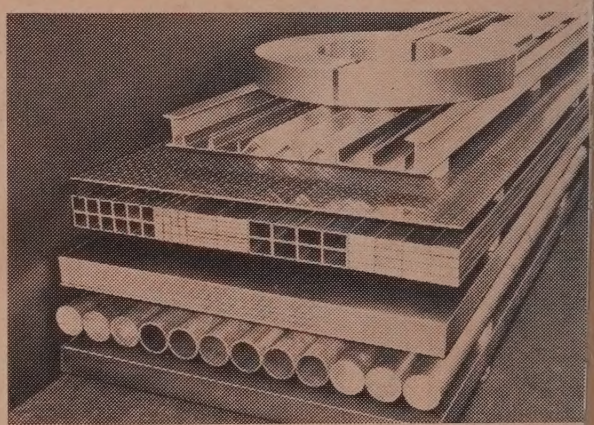

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MODERN METALS

Read in companies that produce, fabricate and cast aluminum, magnesium and titanium, and firms that use these metals in manufacturing end products.

HE SIX operations pictured on this onth's cover represent the very considerle subject matter covered in the articles irting on page 38. Cleaning and finishing e easily the operations most commonly rformed on aluminum. Whether you are nning a small shop or a vast factory, u should find some information of in-est and use to you in your aluminum ork. Plans are under way to reprint all most of these features, and copies will on be available at reasonable prices.

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Modern Metals

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ALL ABOUT ALUMINUM FINISHING **35**
Replies to Modern Metals survey paint revealing picture of the cleaning and finishing operations performed by 327 plants that process aluminum or use it in manufacturing all types of end products. Big opportunities for new and improved finishes seen.

WHEN CLEANING ALUMINUM **38**
you can use solvent cleaners — emulsifiable solvents — emulsion cleaners — hot alkaline cleaners — etch-type alkaline solutions — acid cleaners (deoxidizers) — solvent vapor degreasing (with or without spray or dip) — electrocleaning — ultrasonic cleaning.

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FINISHING SUPPLY SOURCES **112**

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Letters

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The writer is interested in securing a permanent mold casting source which would in turn be interested in an exclusive arrangement for producing a unit used in the suspension of high voltage electric power lines.

The writer is an inventor and developer of a cap for suspension insulators made in aluminum, which is a substitute for, and interchangeable with, the presently-used steel malleable iron caps.

This unit will weigh approximately eighteen to twenty ounces with a strength equal to that of the currently used caps which weigh in the neighborhood of 2¾ pounds.

Market potential runs into millions of units per year with only about eight consumer companies manufacturing insulators.

Should you number among your subscribers permanent mold foundries who might be interested in taking on a proposition of this character, the writer will appreciate such information.

Company must be a well managed one with finances such as to provide unquestioned assurance to the power generating and distributing companies of its ability to assume responsibilities parallel to theirs.

"C" — Michigan

MM — This type of cap, while somewhat complex, could probably be made as a die casting, or a plaster casting.

Not only is it a good idea, but this type of work could lead to other products used by power companies.

We'll gladly forward all inquiries to "C" of Michigan.

How To Clean Aluminum

Sirs:

Have you published any details on the various processes used for cleaning aluminum? We are just starting to manufacture a line of furniture and would appreciate any help you can send. . . .

"P" — North Carolina

MM — We've sent you this issue. Starting on page 38 is a complete "manual" on the subject. And if you want details on finishes, enameling, anodizing or painting aluminum, it's all included in this issue.

The Aluminum Picture

Sirs:

In view of the steel and copper strikes, your August cover showing that July aluminum shipments were at all-time highs is interesting. We particularly noted that shipments of aluminum sheet, plate and foil were at a higher rate than castings, extrusions, and tube. Is there particular reason for this?

Now that the steel strike is in its third month, is there any appreciable let-up in demand for aluminum?

"J" — New York

MM — The big upturn in aluminum sheet output has been due mainly to the high-level activity in the building field and the major inroads aluminum has made for home siding and roofing in 1959. One must also take into consideration the fact that demand for castings and extrusions grew much faster than rolled aluminum products during the past five years. Part of the new sheet demand stems from greatly added promotion on the part of the aluminum

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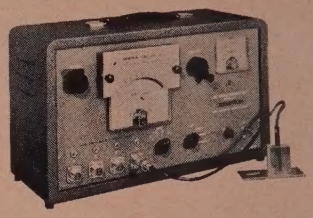

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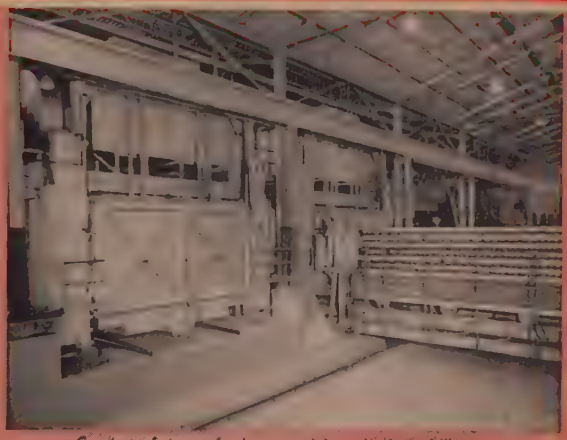

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rolling mills. But give plenty of credit to Jim Price's National Homes for paving the way to selling much bigger quantities to the building and construction industries.

As to how the bigger aluminum firms have been during the steel strike, it depends on how you look at it. The aluminum producers sold every pound they could in July in anticipation of an aluminum strike in August. When it was deferred, most thought that August would be a soft month; were surpised when orders picked up about mid-month and have continued at a lively pace into September. Thus, from an earnings standpoint, third quarter results will be much better than anticipated last July.

If the strike should continue through September (which we doubt), then the whole economy will go into the fourth quarter at a slow pace. If so, this will doubtless affect aluminum sales in October, November and December. Right now there is some substitute buying of aluminum for both steel and copper, and, as before, there is always a part of it that won't convert back when these metals again become available.

The strike hasn't yet hurt most aluminum companies. If it ends before the economy becomes too crippled, it will have been quite an asset indeed.

Chart-Checker

Sirs:

I found the article on new magnesium alloys in **Modern Metals** for May extremely interesting. There is one thing that puzzles me, however,

If you will compare Figure 2 and Figure 3 of this article on page 62, the ultimate tensile strength of alloy HM 21-T8 is approximately 12,500 psi, and in Figure 3, the yield strength of the same alloy is 15,000 psi, both for a temperature of 600°F.

I think it is quite obvious there has been an error. Probably the figure numbers are switched around. I would appreciate hearing from you in this regard.

"P" — Ontario

MM — You're on the ball. At 600°F., HM 21-T8 has a YS of 15,000 psi and a UTS of 15,700 psi.

Our chart artist is currently running a tensile testing machine in Northern Siberia.

Wants Casting Source For Hinges

Sirs:

I have read with interest the June issue of **Modern Metals** and noted particularly the article about Casting and Corrosion. My reference is in regard to plaster mold techniques.

I have developed a new type of door hinge which must be made by a casting method. I have investigated die casting but have been discouraged because of the very high cost for dies.

I am sending under separate cover a sample of the product and would be obliged if you let me know if the design could be executed in aluminum of proper strength from plastic molds or advise a possible manufacturer.

"C" — New York

MM — The postman is sore at us because when he had to haul that ugly, massive, heavy old brass hinge up to our attic the package fell and broke a step.

But you have a good idea and, in aluminum, the hinges should sell.

It could be made by sand, permanent mold or plaster casting. If any industrious aluminum foundry is interested in contacting "C" of New York, we'll promptly forward any inquiries.

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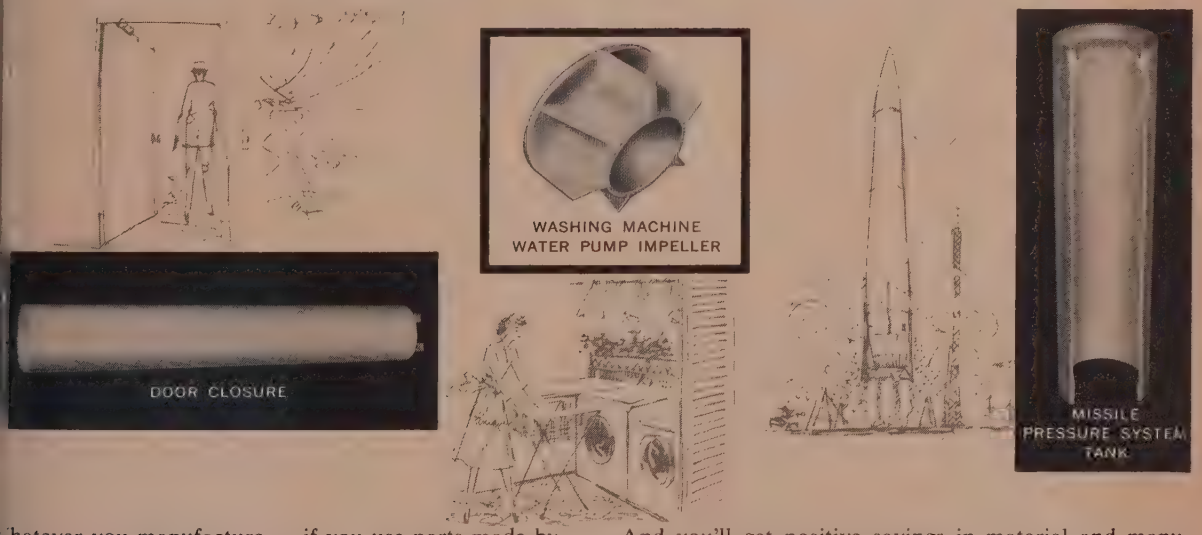

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A major independent producer of quality aluminum in all alloys and sizes: Pig, ingot, billet, rod and bar, pipe, tube, hollow sections, press forgings, forging stock, hand forgings, impact extrusions, electrical bus bar, structurals, special shapes, light and heavy press extrusions, screw machine and other aluminum products. Similar products in titanium, zirconium, and steel. HARVEY ALUMINUM SALES, INC., Torrance, California

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221-225

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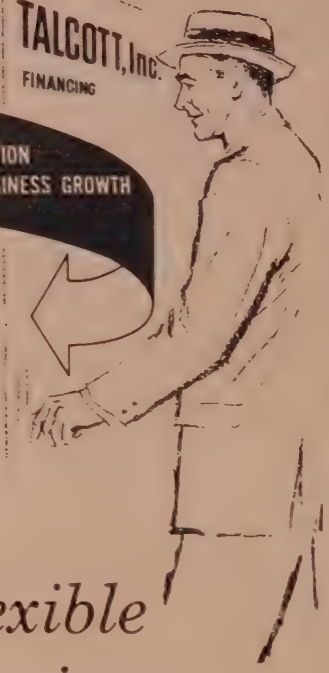

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Here and There

The New Look » » Early in September, Ford Mot Co. thought it newsworthy enough to report its effo to produce better, more durable finishes for its ca Ford's vice president of manufacturing, John Dyksti said its research indicated an opportunity to mo ahead of competition by using exterior auto tri having greater corrosion resistance and lasting e appeal. Next year's models will use as much as 50 more nickel for electroplated parts, more unifor plating on bumper and ornaments; more than doub the required thickness of anodized coatings on al minum parts to afford greater protection; and use a new aluminum alloy to provide high luster, despi the thicker anodized coating. Seems that the complain from car owners about lousy finishes and rusted o parts brought about Ford's new policy. The company also using this up-grading of finishing standards as promotional item. This may be news to the men wh run autoland, but not to anyone who has driven American car. All of the auto makers have been tryi to get by with less finish. At last, one of them seems plating on bumpers and ornaments; more than doub think it's kicking back. This trend isn't confined to th automotive industry, either. Much up-grading is goi on in appliances, furniture, electrical products, co tainers, and houses. Today a good finish on almost ar product will edge out a competitive one, all oth things equal. Gone are the days when a dab of pai on a chunk of steel or wood was thought to be adequat

Cleaners, Coatings and Finishes » » Th foregoing item brings up the subject of this issue Modern Metals. Starting on the cover and continuin for some 34 pages we have tried to take the enti subject of finishes for aluminum and boil it down int readable, worthwhile information. How well we' succeeded will probably be revealed by the number requests for reprints of the entire section. (They' be available at about 50 cents a copy.) When we starte to put this issue together, we surveyed about 940 sub scribers, and out of the 406 who replied, 327 do som or all of their own aluminum finishing. About 75 plan send their work to outside plants for finishing. Th plants that replied told us they do 36 different kind of cleaning or finishing, including cleaning, vapor d greasing, grinding, polishing, buffing, abrasive blastin barrel tumbling, etching, plating, anodizing, lacquerin painting, and so on. The cleaning and finishing "ma ual" starting on page 38 dwells on all of these subject and includes about a dozen case histories telling ho certain operations are performed.

We're Late Because » » Seems that we unde estimated the size of this project and were actuall writing material as late as September 18th. All of has been checked by experts in these fields. We believ it to be accurate. Back on pages 112 and 113 you'll fin a list of manufacturers of various chemicals, equipme and services which apply in this field. While we had n way of knowing every manufacturer, we think the majo

EED ALUMINUM? WHEN?
WHERE? HOW MUCH?

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s things rolling the moment
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your aluminum is **where**
want it, **when** you want it.
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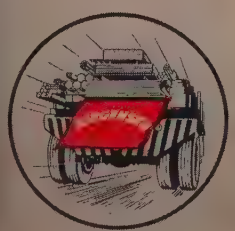

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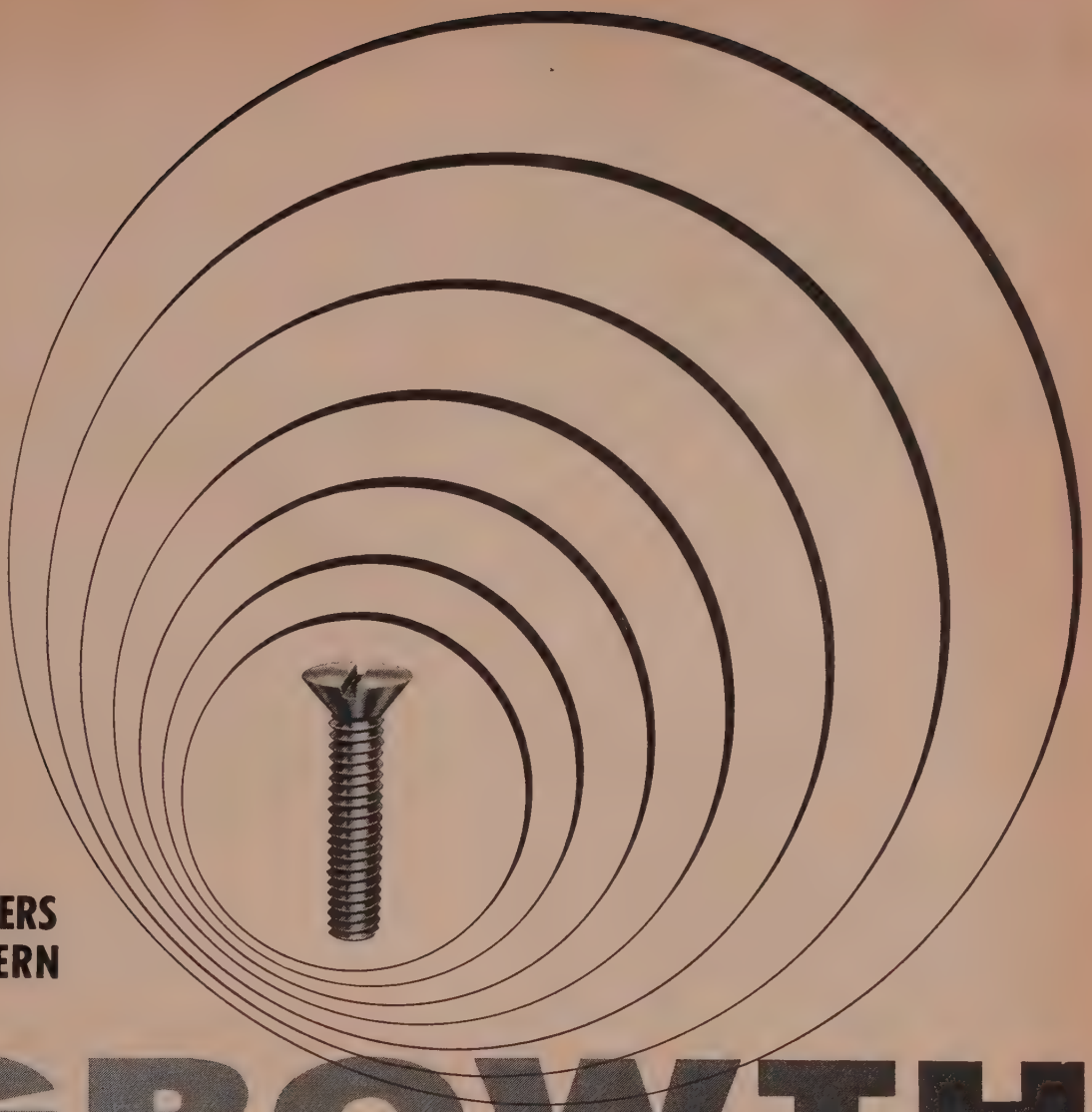
ones are listed. We intended to include a section on finishing magnesium, but we ran out of space. It will be included in our October issue. This is our most ambitious attempt to cover a single subject. It is also our third largest issue. If you find this "manual" helpful a letter expressing your views would be appreciated. (Same goes if you're displeased.) Reason: If a project like this is deemed worthwhile, we may devote future issues to other specific subjects.

Twelve Million » » If you've seen the October issue of the *Reader's Digest*, you may have noted the aluminum foil insert. While foil inserts have been used in magazines and a few newspapers, this is by far the biggest single use for foil for advertising purposes. Alcoa peddled the laminated foil to Tenderleaf Tea—over 2000 miles of the stuff. Tenderleaf Tea is going to find out for sure whether Digest's 12 million readers actually see the ads because they included a half page gatefold containing a 15-cent-off coupon for its tea. Alcoa says the use of foil for advertising substantially increases advertising effectiveness; considers this ad a perhaps the most effective printed promotion ever.

Metal Pants » » The British have come up with a novel use for very thin foil. Its use in drapes and women's dresses is not new, but Howard Rhees of the Shirley Institute in Manchester is sure he can use foil in light weight, inexpensive suits for men. He thinks the material can be worn with the shiny surface facing the body in order to keep heat in and its wearer warm in the winter. Come summer, he reverses the whole thing to keep the heat out and keep the wearer cool. We hesitate to order one of these suits since there isn't an anodizing plant near our cottage, and you have to keep these things clean, you know. If the idea catches on it may not be long before dry cleaners will be advertising: "Suits Anodized While You Wait"!

The Little Ones » » Way back in 1947 a man by the name of Preston Tucker rented a vacant wartime plant in Chicago to make the first postwar dream car: a rear engine job with a body of solid aluminum. He sold about $20 million worth of stock, and when his first ads hit the papers, he received roomfuls of orders in the mail, many of them containing checks. The dream was just that, and 20 million bucks went down the drain. We had the one and only model for several days, and Nick Drystat, then manager of Chevrolet and now deceased, came down to look at the monster. What's wrong with it? we asked. Nothing that a little engineering wouldn't fix, he replied. "Why doesn't General Motors build it?" we asked. It would cost over a billion dollars to convert, Drystat explained, and why spend that kind of money when the public would buy anything they put out. Henry Kaiser also tried making a small car, but his "Henry J" just didn't make it. It took half a million European small cars and the Nash Rambler to awaken Detroit. By the look of the newspapers these days, you'd think the Big Three invented the small car. So we'll be seeing GM's Corvair, Ford's Falcon, and Chrysler's Valiant this fall. But how many? The talk is that sales will run between a million and a million and a quarter units next year.



IN ASTENERS OUTHERN IS

GROWTH

omeone has said that it is no longer possible for usiness to stand still, for those which are sta-onary are left behind by those who are "on the row." Southern Screw Company's *growth* in a mparatively short time is due to its ability to ake better products for *growing* customers. outhern is dedicated to making better fasteners, iving better service, providing better packag-g—at prices that are fair and competitive. It is ot strange that Southern Screw's *growth* has ept pace with those we serve.

yours is a *growth* company, Southern Screw in ll probability is having an important part in our progress. If we are not now *growing* with ou, perhaps it would be mutually beneficial to ecome a part of each other's *growth* pattern.

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New Enterprise

Bauer Aluminum Company has been formed i Richardson, Texas (near Dallas) by Art G. Bauer, a engineer who has been in the extrusion business fo 10 years. The 17,000 square foot plant contains a 155 ton Watson-Stillman press and a Magnethermic indu tion billet heater. The **aluminum extrusion plant** wi be in production in November.

Another **new extrusion plant**, located at Standifor Field in Louisville, Kentucky, is called Extrusions, In The plant, now in production, is headed by Joe Id who has helped start several other successful extrusio operations around the country.

There is also good activity in the impact extrusio business these days. In Milwaukee, Como-Cast Corp ration, a division of Basic Products Corporation, ha already received about 7 orders for its new line **slug casting machines.** Como-Cast Corp. claims th slug manufacturing process is more economical tha prior methods.

Heat dissipation is aided in enclosed machine to **motors** by the use of cast aluminum alloy frames an fin-type design. The motors are made by Reuland Ele tric Co., 3001 W. Mission Rd., Alhambra, Calif., i ratings from 1/3 to 10 hp.

Adhesive aluminum foil **letters and numbers die-c** 3 inches high are available from W. H. Brady Co., 7 W. Glendale Ave., Milwaukee 9, Wis. Full soft m terial will curve, conform and adhere to surfaces.

Frame and handle of Caddy **Water Hose Reel** ma by The Specialty Mfg. Co., 2356 University Ave., Paul, Minn., contain drawn aluminum furniture tu ing. Reel is made of plated steel. Reel affords an ea way to store, use and transport hose.

Numerous types of **aluminum handles** are coming the market this year for new uses. One, a tubul aluminum handle for electronic chassis and assembl that has a mounting hole in each leg. The hand come in anodized black or color from Alpine Electro Components Corp., Wolcott Road, Waterbury, Cor Another is a utility knife with blade which is tractable into the handle — and made of an aluminu casting. The manufacturer is Anderson Tool a Manufacturing Co., 3450 N. Kostner Ave., Chicago

Aluminum foil used in **projection screens** refle light so well that movies and slides are easy to vi even in well-lighted rooms, according to its manuf turer, Lightmaster Screen Co., 12270 Montague Pacioma, Calif. Foil is corrugated with 22 ribs sq. inch.

New company which manufactures aluminum au **motive trim** occupies a 30,000 sq. ft. building in Cu

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ALUMINUM

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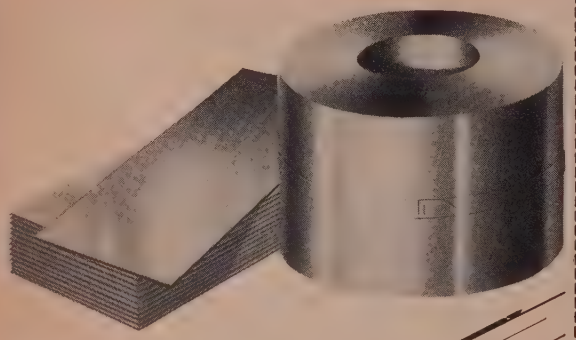

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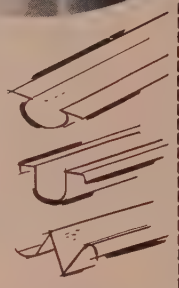

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man, Ala. Named the Cullman Products Division of the Serrick Co., it is expected to employ about 130 by the end of the year.

Perfection Metal Products, Inc., 815 36th Way N., Birmingham, Ala., supplier of **aluminum frame** and components for the aluminum screen and storm window industry, is now a division of the Aluminum and Chemical Corp., Greenwich, Conn. Clyde Winter continues as president and general manager of the new division.

Coming on the heels of Dow Chemical's announcement of the formation of Dow Metals Products, the company plans to produce **hydr-t-metal.** This mixture is a blend of titanium, copper, and zinc, and it will be fabricated at Dow's Madison, Ill. magnesium rolling mill. Dow has an agreement with the developers of the alloy, Hydrometals, Inc. of Chicago.

An improvement in irrigation systems which should gain wide appeal is an **aluminum water control box** called Porta-Plank Irri/Gate. Manufactured by Wesco Products Corp. of Walla Walla, Wash., the box is assembled by driving interlocking 8-inch aluminum members into the irrigation ditch. It is bolted to an aluminum spillway.

A new die casting firm called Precise Castings, Inc. has been formed in Lafayette, Ind. One objective is to perfect a **new vacuum casting process for aluminum** and zinc alloys. The president is John Sikorski, formerly with S. U. S. Die Casting Co., Ted Pickering, previously with Doehler-Jarvis, is vice president.

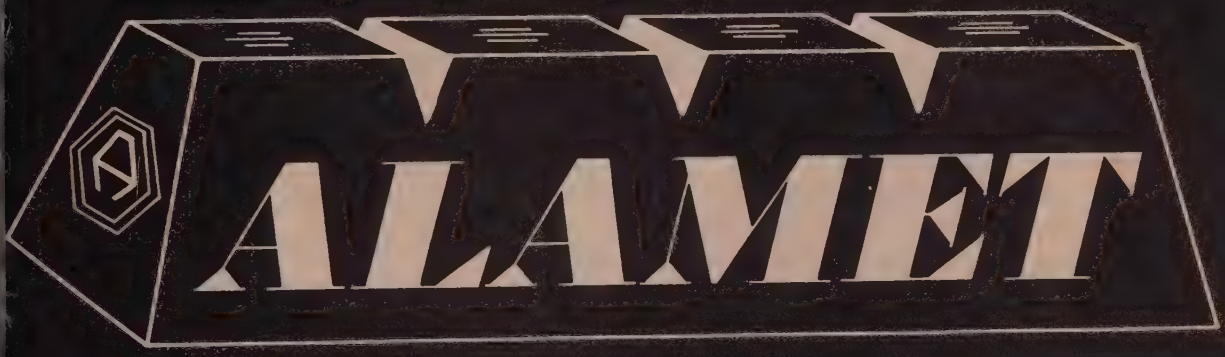
Millwork manufacturer and distributor, International Sash & Door Co., 2101 N.E. Broadway, Minneapolis, Minn., has purchased Universal Standard Aluminum Co. "Operations of the two companies are being consolidated at International's warehouse and office building," said Martin Capp, a director of International Sash & Door.

Nylon-covered, plastic-insulated **aluminum rivets** are used to fasten electrically conductive metal parts and for riveting to glass, where nylon acts as a shock absorber. Pylon Co. Inc., Attleboro, Mass., makes the rivets; also in brass, steel and other metals.

Aluminum **globes** measuring 6 ft. in diameter are made by hydraulically forming .064-in. circular sheet of aluminum. Dyna-Graphic Display, Inc., 345 Carroll St., Brooklyn 31, N. Y., is the manufacturer of the circular maps which are diametrically accurate to 1/32-in. The painted globes are covered with a vinyl film for a non-glare, easy-to-view surface.

Several new aluminum products for use around the home have recently come on the market. One is **garden trellis** made by Trio Manufacturing Co., Griggsville, Ill. Made of tubular aluminum, the units are easily assembled with snap-on clamps and are available in fan or rectangular designs. Another is a line of **cast aluminum brackets** for outdoor flower boxes, bird

Remember this name — ALAMET! America's newest source for Magnesium and Calcium Metals.



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B&P MAGNESIUM DOCKBOARDS

EXCLUSIVE ONE PIECE CURB —WITH FORGED ENDS

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MORE EXCLUSIVE FEATURES LESS

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Full length hand grips, light weight and yellow curb marking assure safe handling. The exclusive one piece curb with forged ends assure strength and longer life.

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Strong and safe for rolling loads up to 4800 pounds. Choice of surface finish: smooth, raised pattern or abrasive coated. Designed and marked for safe, fast economical loading.

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HAND TRUCKS

The magnesium hand truck shown here is another fine B & P product. B & P has a line of non-powered floor trucks of all types.

60-MH-1

Write for literature.

BROOKS & PERKINS, INC.
1954 West Fort St., Detroit 16, Michigan

Write for NEW Folders

feeders, or milk containers, made by Lev-L-Brac, 38 Norfolk St., Dorchester 24, Mass. Aluminum redwood **personalized house signs,** that utilize aluminum extrusions, are made by Fidler-Ross Co., Camden 2, N. J. Another is a line of **magazine house racks** which are made of anodized extruded aluminum and contain five pockets for various sized magazines. The manufacturer is The Rak Makers, 61 Hamilton Place, New London, Conn.

Fairchild Engine & Airplane Corp., Hagerstown, Md., after experiencing some cut-backs and heavy losses over the past two years, has acquired an $8.5 million contract for **subassemblies for Boeing's Stratofortress.** Fairchild has recently acquired a new president, J. H. Carmichael.

One of the larger **magnesium and aluminum foundries,** Rolle Manufacturing Co., of Lansdale, Pa., has been purchased by DEK Industries, Inc., the latter's recent entry into the aluminum roofing and siding business. Rolle has had tough sledding for most of its 15 years in business, and has been owned by several managements. Current annual sales volume is about $6 million a year. Castings output has been mainly for the aircraft and missiles industries.

A new twist in **casement, awning and picture windows** has been developed by Jervis Corp., Grandville, Mich. Windows are made throughout of extrusions except the inside sashes, which are made of wood bonded to the aluminum frame. Prepunched holes make for easy nailing to the studding.

New plants are occupied by two **mobile homes manufacturers** in Tampa, Fla.: The D. W. Strahan Mfg. Co., 4016 N. West Shore Blvd., and Futurama Mobile Homes, 7800 W. Hillsbro Ave.

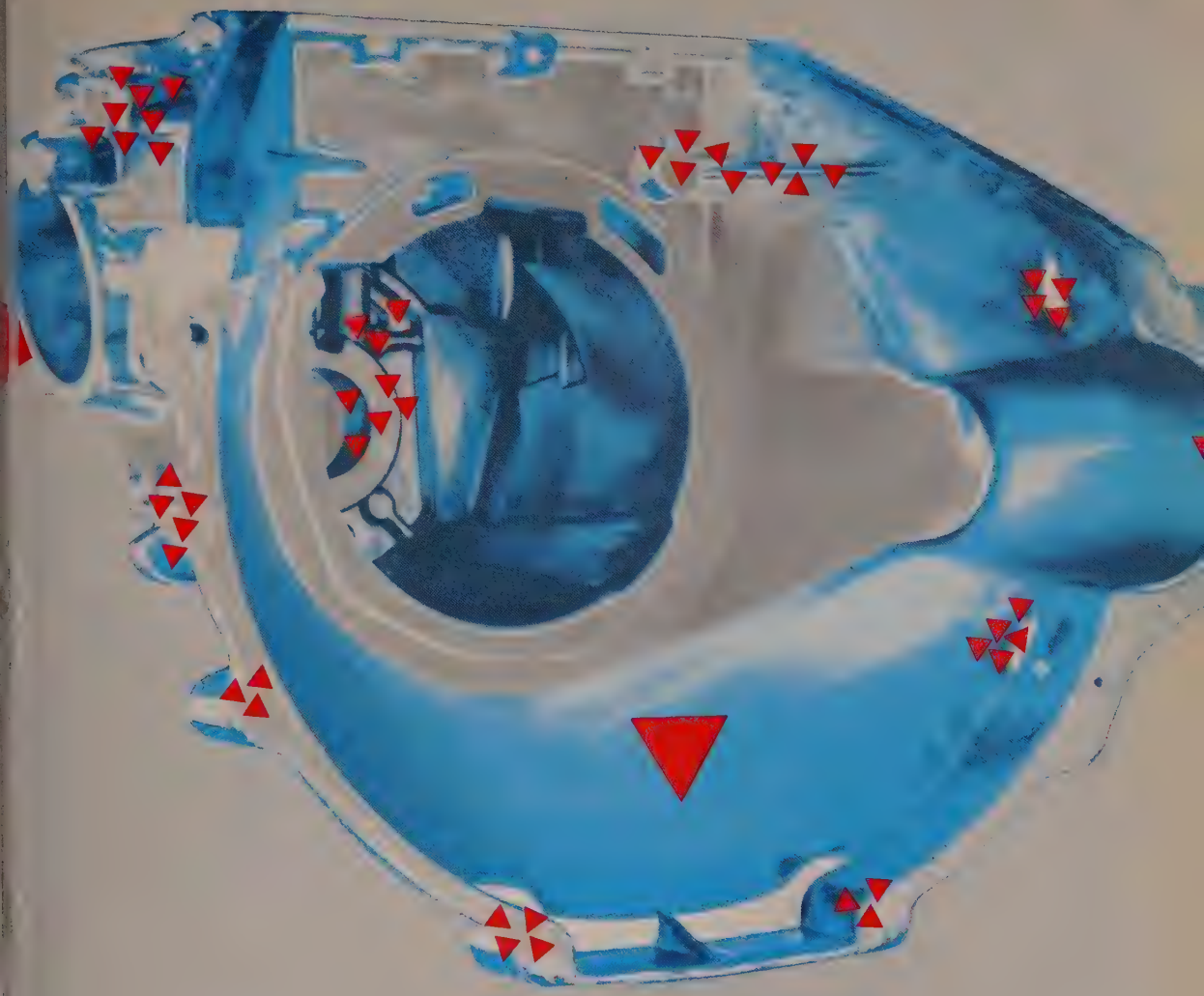
Croname, Inc., 3701 N. Ravenswood, Chicago, decorative metal manufacturer, is now licensed to produce Alcoa's **"Spangle Sheet,"** a new aluminum sheet which is given a highly exaggerated and visible grain structure by a special mill process.

New **ladder** for hooking on pleasure boats is made of aluminum tube by Capco Products, P.O. Box 50, Columbus 16, Ohio.

One firm that is trying to beat the competition of imported specialty steel pipe and tubing is Damascus Tube Co., Greenville, Pa. This fabricator is expanding to produce tubing up to 75 feet long; hopes to develop demand for **close-tolerance tubing** made of rare and reactive metals such as titanium and zirconium.

More and more steel fabricators are adding aluminum to their lines. One of the latest is Erie Enameling Co., Erie, Pa., which manufactures procelain enamel steel panels. In order to become a single source for insulated and non-insulated **curtain wall panels,** Erie is now fabricating panels of aluminum and stainless

(*Continued on page 25*)



in castings...

Alcoa puts the metal where you want it

The design areas in this permanent-mold casting are pegged in red. The part itself is an automatic transmission housing for the '59 Ford car. It weighs 24 lb, 61 lb less than its cast-iron predecessor. The cyclone forces that whirl through modern automatic transmissions bring stress ranges in some parts of the casting up to 21,000 psi. The problem was to provide adequate strength without unnecessary weight in the casting walls.

Alcoa was not only able to offer a complete test facility, but was able to offer some sound design tips, too. Stresscoat and strain gage tests revealed the areas where special design attention was necessary. We were able to produce the parts to meet the exacting production schedule of the automotive industry.

In castings as well as forgings, screw machine parts, extrusions and impacts, Alcoa puts the metal where you want it. To you, this may mean fewer rejects, or it could provide the key to ingenious solutions for difficult design problems. Start now; write for Alcoa's Up-To-Dater, a starter file of ideas and design tips on Alcoa Engineered Products. Aluminum Company of America, 917 Alcoa Building, Pittsburgh 19, Pennsylvania.

ALCOA ALUMINUM

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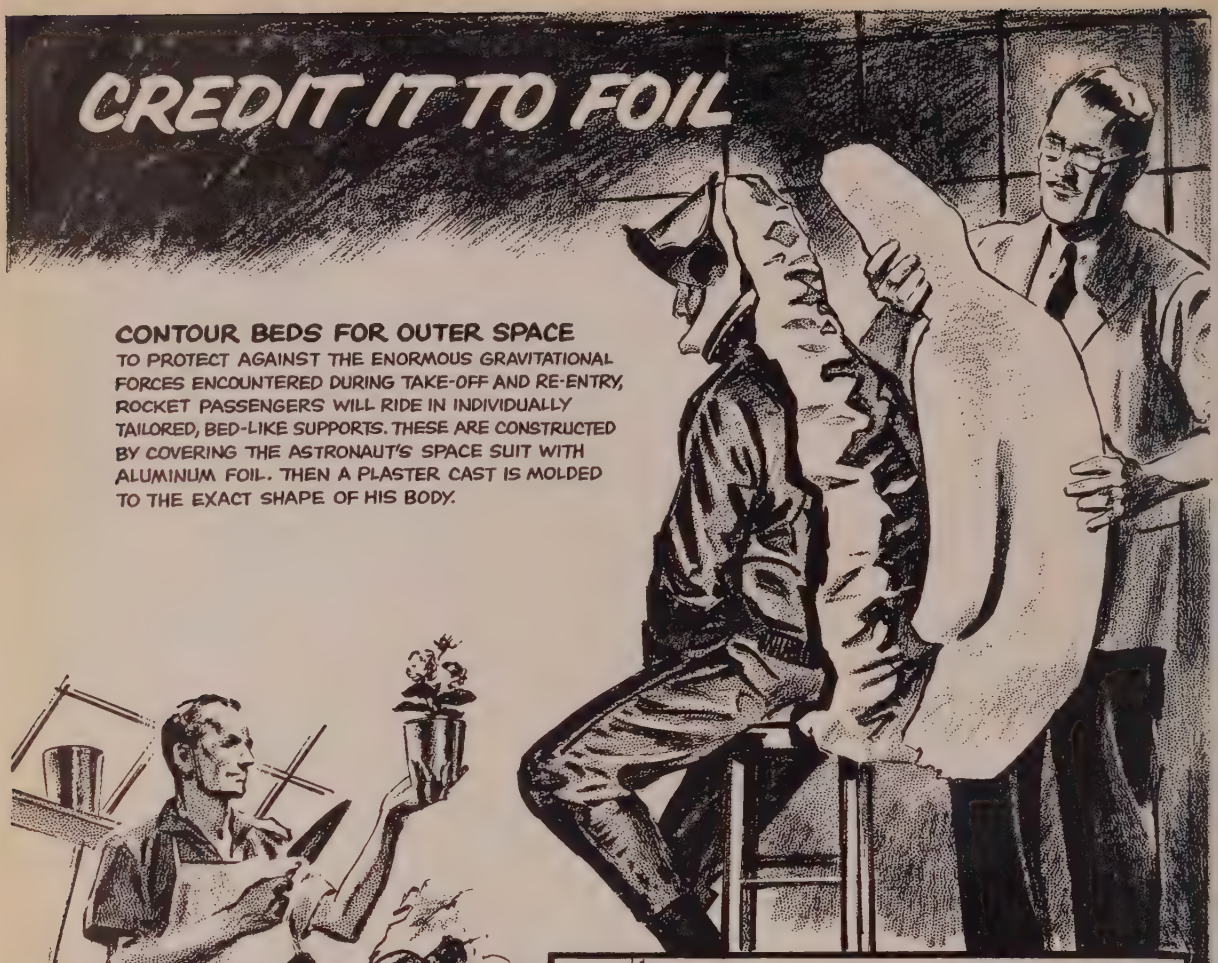
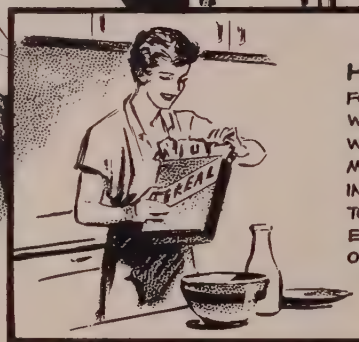
"STRESS AREAS"

CREDIT IT TO FOIL



CONTOUR BEDS FOR OUTER SPACE

TO PROTECT AGAINST THE ENORMOUS GRAVITATIONAL FORCES ENCOUNTERED DURING TAKE-OFF AND RE-ENTRY, ROCKET PASSENGERS WILL RIDE IN INDIVIDUALLY TAILORED, BED-LIKE SUPPORTS. THESE ARE CONSTRUCTED BY COVERING THE ASTRONAUT'S SPACE SUIT WITH ALUMINUM FOIL. THEN A PLASTER CAST IS MOLDED TO THE EXACT SHAPE OF HIS BODY.



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el with or without porcelain finishes. The company also making a laminated panel by a new process led Laminall, which provides a molecular bond beeen materials.

With the developing market for all types of **children's** rs, Production Engineering Co., Austell, Ga., has me up with an aluminum job that weighs less than 0 pounds. Called the Buckaroo, the midget car goes mph. and gets 50 to 80 miles to the gallon. It s aluminum bumpers, engine, seat frame, brakes, and m. It is powered by a 3 hp. engine, and its aluminum insmission has three positions — neutral, drive, and verse.

A picnickers **iceless icebox** costing a fraction of conntional coolers is being made of aluminum foil mination by Stone Container Corp., Philadelphia 36, a. Having special air cell construction, it is said to sulate as effectively as metal coolers with double alls. The collapsible containers are folded flat for ipment and may be finished in colorful printed signs. The lid also serves as a convenient carrying ndle.

New **packages** for Mirro Foil-Wrap depict in pictures actical and decorative features of the foil. Roasted wl, charcoal broiled hamburgers and other morsels oked on foil are shown. Mirro Foil-Wrap is being oduced by Mirro Aluminum Co., Manitowoc, Wis., a new $12,000,000 aluminum rolling mill.

Bearings are canned by McGill Mfg. Co., 100 N. afayette St., Valparaiso, Ind., in deep-drawn **aluminum cases** made by Kaiser Aluminum and Chemical orp.

Some coal mining towns try to do something about ie unemployment problem when their mines shut own. Hazleton, Pa., for example, lured Highway railer Co. into building a 140,000 square foot plant which to produce **truck trailers and cargo containers** ade of aluminum. The plant is employing 150; hopes increase its payroll to 450.

Three new aluminum compression **electrical connectors** are made by Anderson Electric Corp., P.O. rawer 2151, Birmingham 1, Ala. DCL compression L" tap comes in 15 sizes for connecting combinations No. 8 solid aluminum or copper to No. 2 stranded uminum, copper or ACSR. DCT compression tee omes in 40 sizes for cable combinations from No. 4 randed through 400 MCM cable. DCN neutral compression splice is available in ½ and ⅝-in. od. sleeves or use with combinations of No. 6 stranded to No. 0 stranded cable.

Porch railings and columns, door grilles and awning rackets, incorporating **aluminum extrusions** for structural members and ornamental scrolls and spindles, highlight the line of building products made by Sterling actories, 2620-40 Cherry St., Erie, Pa.

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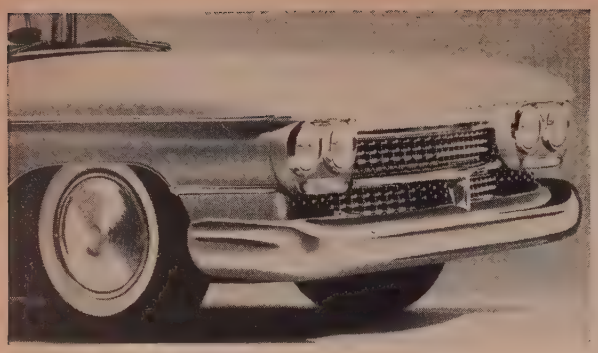

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Useful Data

Bonderite for Aluminum, for use on unfinished o painted products, which protects, preserves and pro vides an excellent paint base for painting, is describe in a four-page bulletin by Parker Rust Proof. I explains this chemical method of coating aluminun without the use of electric current and how th process converts surfaces to an oxide or phosphate integral with the metal itself. It also describes th five-stage operation — cleaning, rinsing, bonderizing and two additional rinses. Contact Frank Hendricks Parker Rust Proof Co., 2177 East Milwaukee, Detroit Mich., for copies.

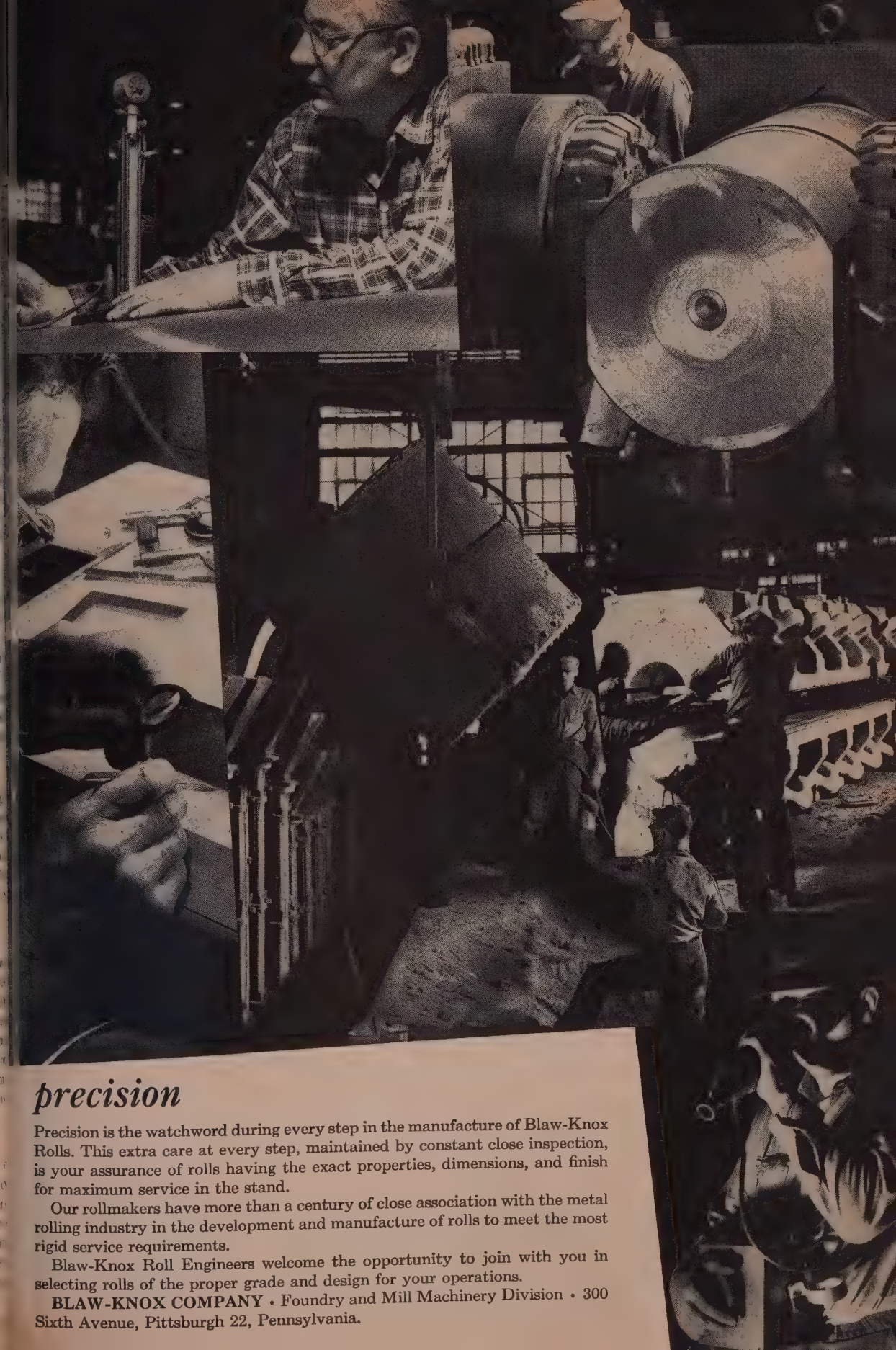
"Building Design and Execution: A Joint Search fo Perfection" is the title of a new publication of Kawnee Co., Niles, Mich. This handsomely designed and colo ful booklet cites a premise that "Perfection, man' ultimate goal, is unattainable" and then proceeds t demonstrate the firm's zeal in its pursuit of perfectio in its products. Finishing and checking practices a Kawneer plants are pictured and interestingly de scribed. Write to Dick Mattson for this booklet.

Metal Preparation Service Plan, a 10-page bookle by Pennsalt Chemicals, explains the company's servic —from the design, installation and servicing of variety of metal preparation and finishing machine to the compounds and chemicals themselves. Th booklet covers processing materials, processing m chines, and personal services rendered by Pennsa Chemicals Corp., Penn Center, Philadelphia 2. Copi may be obtained by writing R. T. Mills.

Titanium anodizing racks is the subject of an eigh page booklet containing data on why titanium rac cost less to use, why they are efficient, various types racking systems, as well as information on custom-bui racks. Prices for various sizes are also included. Wri E. Rosner, Servi-Sure Mfg. Co., 131 North Green S Chicago 7, for your copy.

A fact sheet on the Kenvert-O-Color process, showi how color can best be applied to certain nonferro metals is a recent release of Conversion Chemical Cor The data sheet also suggests the use of dyes in co bination with the appropriate chromate film to obta the desired qualities of wet strength hardness, econom ease of application, and uniform finish without bru ing or marking. Write to K. F. Bellinger, Conversi Chemical Corp., Rockville, Conn.

Data on refractory cements have been revised in new booklet, "Cements, Mortars, Coatings" by Mex Refractories Co., Division of Kaiser Aluminum Chemical Corp., Mexico, Mo. The 16-page book contains description and data on the expanded line refractory products, including mortars for gene metallurgical applications; general purpose morta



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A metal cleaning handbook devotes 32 pages t over 100 types of equipment and techniques for th cleaning and preparation of metal surfaces. It cover the basic factors in metal cleaning and specific method to meet a variety of cleaning problems such as degreas ing, washing, bonderizing, stripping, drying, phos phatizing, pickling and coating. For a copy writ Russell Kreie, Magnus Chemical Co., Inc., Garwood N. J.

How to "get the most from crucible melting" is collection in pamphlet form of a series of papers d signed to help foundrymen gain added economies an flexibility in their use of melting crucibles. The pam phlet contains chapters on: Furnace Maintenance an Care; Burner Design and Furnace Atmosphere; Hard ware—Ladles, Tongs and Shanks; Charging and Mel ing; Refractory Crucibles in the Die Casting and Pe manent Molding Industry; Exhaust Systems; and Larg Capacity Crucibles. In addition, the pamphlet co tains recommended standard nomenclature and de nitions covering graphite refractories. The Crucibl Manufacturers Association, 11 W. 42nd St., New Yor 36, will send this publication on request.

Cylindrical Grinding Wheels by the Macklin Co. Jackson, Mich, is the title of a four-page brochur describing cylindrical grinding wheels. It explains th desired characteristics of cylindrical wheels as well a the abrasives and bonds employed for various cyli drical cutting operations. It also contains wheel te records and wheel recommendations for cutting wide range of metals.

A new bolts and screws price list has just bee released by Southern Screw Co. The catalog has eigh pages of list prices on packaged wood screws, Type tapping screws, machine screws, machine screw nu stove bolts and carriage bolts. Valuable time is save with Catalog P-1 because it eliminates need for thum ing through an "all-inclusive" catalog to find the pac aged items. Write to J. D. McDade, at Box 136 Statesville, N. C.

Equipment for the Surface Treatment of Met details the machinery and machinery systems for su metal surface processing as cleaning, washing, rinsi drying, spraying, and dip coating. It also illustra and describes drum-type machines, conveyor machi and systems, monorail machines, and automatic fini ing systems. It is illustrated with photos and flow d grams of actual in-plant installations. For copies wr Robert LaBoiteaux, Ransohoff Co., Hamilton, Oh

Revere Aluminum Tube is the title of an exhaust 48-page book, perhaps one of the most detailed pres tations on aluminum tube yet published. It conta comprehensive information on the selection of pro

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tube alloys, temper designations for aluminum tub and resistance of alloys to various chemicals. Ther are also detailed sections on seamless drawn aluminum tube, extruded tube and pipe, welded tube, lockseam and butted aluminum tubes, as well as Tube-In-Strip The book contains tables which include typical prop erties and property limits of tube, standard tolerance for all types of tube and pipe, and weights per foo of aluminum tube in various alloys. Write Dick Snively Revere Copper and Brass, Inc., 230 Park Avenue, Ne York 17, for a copy.

Mechanical finishing is covered in two booklets b Murray-Way Corp. One bulletin describes buffing a Ford's Monroe plant and shows several installatio which are automatic. The other discusses buffing, po ishing, grinding, filtering and coating by illustratio of automatic installations. Get a copy by writing F Zech, Murray-Way Corp., Box 180, Birmingham, Mic

Recommended machining speeds and feeds for alum num have recently been published in chart form b Peter A. Frasse & Co., Inc., aluminum distributor. Th tables apply to six different machining operation forming, turning, drilling, boring, reaming and cu ting off. A cutting speed conversion table is include for added convenience. The chart is 8½ x 11 inche three-hole punched and tabbed. Ask William Stoeb Marin Ave., Lyndhurst, N. J., for copies.

Colors for Anodized Aluminum. The Chemicals ar Dyestuffs Division of Koppers Company, Inc., Koppe Building, Pittsburgh 19, Pa., after several years research on dyes for color anodizing aluminum, h developed a line of new colors and advanced tec niques for applying them. An extensive brochure whi details available colors with fastness ratings, as we as a step-by-step explanation of anodizing procedur is available by writing J. J. Marshall.

Die casting standards for threads; fillets, ribs an corners; and lettering and ornamentation have be published by the American Die Casting Institute. addition to these Engineering (E) Series of standar the Institute has previously published a Metallurgic (M) Series and a Commercial (C) Series. With t issuance of these new standards, the E Series totals pages and covers all of the following subjects: Line Dimension Tolerances; Parting Line Tolerances; Me ing Die Part Tolerances; Draft Requirements f Walls; Flatness Tolerances; Depth of Cored Hol Draft Requirements in Cored Holes; Cored Holes f Tapping; Ejector Pin Marks; Flash Removal; Angula ty Tolerances; Concentricity Tolerances; Machini Stock Allowance; and the new subjects mention above. Dick Kellers will send these new pages request. He's at 366 Madison Ave., New York 17.

Aluminum warehouse stocks of Edgcomb Steel are given pictorial presentation in a new eight-p booklet prepared by the company. Described are sheet and plate, coil stock, tube, bars and extrusi Write to Sandy Monigle at Edgcomb Steel, D St. a Erie Ave., Philadelphia 34.

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6 GOOD QUESTIONS ABOUT ALUMINUM FINISHING . . .

If you have a question about aluminum finishing, the chances are your Kaiser Aluminum Distributor can answer it. Experience and metal know-how are as much his stock in trade as top quality aluminum. Use his fund of technical knowledge, backed by the engineering ability of Kaiser Aluminum's field staff.

Here are the answers Kaiser Aluminum Distributors have given to specific questions about finishing aluminum asked by various fabricators. If you don't see the answer to your question here, ask *your* Kaiser Aluminum Distributor.

Q. **We're tooling up for a new design having a frosted finish. What's the best way to get a frosted appearance on aluminum?**

A. Etching with an alkaline solution is the most common method of producing a frosted finish on aluminum. A 5.0% solution of sodium hydroxide, or a solution containing 5.0% sodium hydroxide plus 0.5% sodium fluoride, can be used. The temperature of the solution and the time allowed for etching are determined by the degree of etch desired. Aside from etching, you could polish the aluminum surface with an extra fine abrasive cloth, or air blast with fine abrasives.

Q. **Technically, what is anodizing and how thick is an anodized coating?**

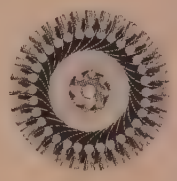
A. Anodizing is an electrochemical finishing technique that works like this: Aluminum is made the anode in an electrolytic cell containing an acid electrolyte, such as 15% sulfuric acid. The surface of the aluminum is converted to a hard, corrosion resistant film of hydrated aluminum oxide. After the oxide film has formed, it may be converted, by a very simple procedure known as sealing, to a more definite crystalline form of aluminum oxide with increased corrosion resistance. By varying the anodizing conditions, different thickness can be achieved. Normal commercial thickness ranges from 0.0003" to 0.0009".

Q. **We're using alloy 5005 sheet and extrusions. What alloy or alloys will give us a good color match for anodizing?**

A. The chart in Figure 1 will show you color matches for various aluminum alloys at a glance.

Q. **How can I polish a contoured aluminum sur**

A.



One of the best methods is a brush-backed, motor d polishing head as shown The abrasive cloth is ser and is located in strips nately between the brush the polishing head revolv brushes adapt themselves contour and the abrasive does the polishing.

Q. **Is surface preparation necessary before pa aluminum?**

A. Since an aluminum surface does not naturally paint (has no "tooth") it is necessary to prepa surface before painting. Two general metho used: (1) Chemicals combined with the prim etch while the primer is drying, and (2) Etc surface with chemicals first, then apply the pa a conventional manner. Usually the applicatio primer is advisable to minimize paint failure paint used should be top quality, but avoid base paints.

Q. **Which abrasive do you recommend for poli aluminum — carborundum or aluminum oxi**

A. If no subsequent finishing is required, good r can be obtained with either. However, if th minum is to be given a final anodizing treat imbedded polishing residues from carboru (silicon carbides) will often produce mottled, ened surfaces. In such cases, it's best to use a num oxide abrasive to avoid such discoloration

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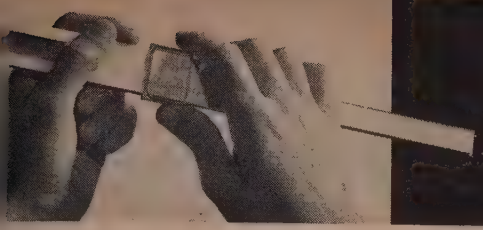

AND 6 GOOD ANSWERS BY KAISER ALUMINUM DISTRIBUTORS

Fig. 1

APPROXIMATE COLOR MATCHES OF ANODIZED ALUMINUM ALLOYS

0 = Relatively Good Matching X = Better Matching

	Sheet and Plate Alloys											Extrusion Alloys				
Sheet and Plate Alloys	1100	2024*	Alclad 2024	3003	5005	5050	5052**	6061	Alclad 6061	7075*	Alclad 7075	3003	2024*	6061	6063	7075*
1100	X	0	X		0					0			0			0
2024*	0	X			0								X			
Alclad 2024	X		X													
3003				X								X				
5005	0	0			X	0	0	X		0			0	X	X	0
5050					0	X	0	0		0				0	0	
5052**					0	0	X	0						0	0	
6061					X	0	0	X						X	0	
Alclad 6061									X		X					
7075*	0				0					X						X
Alclad 7075									X		X					
Extrusion Alloys																
3003				X								X				
2024*	0	X			0								X			
6061					X	0	0	X						X	0	
6063					X	0	0	0						0	X	
7075*	0				0					X						X

Heat treated and quenched. ** For relatively thin anodic coatings, i.e., not exceeding 20 min. anodizing time.

FREE BOOKLET. Your Kaiser Aluminum Distributor offers free information and technical data in an informative new booklet, *"Designing With Aluminum."* This helpful manual contains 23 useful articles on how to use aluminum to your best advantage.

For your free copy, write on your business letterhead to the nearest Kaiser Aluminum Distributor named in the list below. Or, contact *Kaiser Aluminum & Chemical Sales, Inc., Dept. TE-1087, 1924 Broadway, Oakland 12, Calif.*

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.. all about ALUMINUM FINISHING

Replies to Modern Metals survey paint revealing picture of the cleaning and finishing operations performed by 327 plants that process aluminum or use it in manufacturing all types of end products. Big opportunities for new and improved finishes seen.

NEARLY two and a half million tons of aluminum will be con-med in the U. S. this year. Most of is record tonnage of aluminum will converted from raw pig and ingot to intermediate forms such as sheet, ate, extruded shapes, tube, rod, bar, ire, castings, foil, forgings, and the ke. And these useful forms will then further processed into countless man-factured products ranging from air-lanes, appliances and automobiles to rniture, toys, utensils and windows.

In the transformation from pig and got to completed product the alumi-um will be subjected to many metal-orking operations, the most prevalent which will be cleaning and finishing. xactly how much this will amount to a square foot basis is all but impos-ble to determine.

But take aluminum sheet, plate and il as an example. Indications are that ipments of these rolled products will pproach 2 billion pounds in 1959. If is amount of aluminum was rolled own to .072-inch thick sheet (alloy 100) the result would be nearly 2 bil-on square feet of aluminum sheet.

If both sides of all of this sheet were require at least one cleaning or fin-hing operation, it would amount to lmost 4 billion square feet — or 90,000 cres — of treated aluminum surface.

inishing Is Big Business

This is purely hypothetical, of course the total square footage of treated luminum surface could actually run igher than that — but it helps illustrate ne fact that the cleaning and finishing f aluminum is really big business. hat's what this special issue of Modern letals is all about.

In order to get an idea of what types f cleaning and finishing operations are erformed by plants that process alu-inum and/or use it in manufacturing nd products, Modern Metals last month ailed a survey questionnaire to 940 plants, picked at random from our subscription list.

The questionnaire was of the fill-in type. The respondent merely checked the appropriate boxes, thus indicating whether his firm did some, all or none of its own aluminum finishing, and which cleaning and/or finishing operations were performed in his plant. He then mailed the filled-in questionnaire back to Modern Metals.

The Replies: A Hefty 43%

Of the 940 questionnaires mailed out, 406 have been returned. This 43% is a respectable rate of return by any standard. (We expected something like 10% or 15%.) What's more important, the results of the survey probably present a fairly accurate picture of the cleaning and finishing operations performed in the aluminum industry because the plants surveyed represent a pretty good cross section of the industry.

In addition, the respondents were promised complete anonymity, thus minimizing any temptation to either "load" the questionnaire or hold back information.

Of the 406 firms that returned the questionnaire, 79 said that they do none of their own aluminum finishing, 187 do some of their aluminum finishing, and 140 do all of their own finishing. Magnesium or titanium finishing operations were reported by 24 plants. (Two of these are included in the group of 79 plants that do no aluminum finishing.)

Dividing the finishing operations into six broad groups, we find that 271 plants perform at least one cleaning operation; 249 do some sort of mechanical finishing; 183 do some type of chemical finishing; 120 perform at least one electrochemical operation; 200 do organic coating; and 10 apply porcelain enamel to aluminum. (For the number of plants that perform specific operations within these groups, see the chart on page 36.)

To bring the picture into sharper focus, we divided the replies into six industry groups — building products, aluminum processors or fabricators, consumer durable goods, aluminum finishing plants, industrial and commercial equipment, and miscellaneous. The purpose was to determine what types of cleaning and finishing operations predominate in each of these rather arbitrarily selected groups.

The building products group comprised 96 plants, or 29% of the plants that do some or all of their own aluminum finishing. Among the products made by these plants, windows are out in front by a substantial margin (made by 39 plants). Other products that are very much in evidence include doors, curtain walls, screens, storefronts, and awnings.

What They Do

Within this group buffing operations were reported by 56% of the plants; solvent cleaning by 55%; caustic etching by 55%; alkaline cleaning by 48%; polishing by 48%; clear lacquering by 46%; spray painting by 45%; grinding by 38%; acid cleaning by 33%; sulfuric acid anodizing by 30%; barrel tumbling by 27%; vapor degreasing by 26%; and bright dipping by 21%.

Other operations were reported by relatively small numbers of plants in the building products group. Precoated aluminum coil or sheet is purchased by 16 of them.

The next largest group — aluminum processors and fabricators — is made up largely of extruders (24 plants), foundries (15 plants), and other firms such as sheet metal fabricators, wire drawers, and rolling mills. Total number of plants in this group is 79.

The operation reported by the most plants is solvent cleaning (65%). Polishing is done by 52%; grinding by 51%; buffing by 51%; alkaline cleaning by 43%; vapor degreasing by 42%; spray painting by 38%; caustic etching by

37% acid cleaning by 32%; sulfuric acid anodizing by 32%; and bright dipping by 28%.

Understandably enough, few of these firms (7) purchase precoated coiled or flat stock. The fact that they do, however, probably indicates that some of these plants could be grouped under product categories rather than processors and fabricators.

The consumer durable goods group covers a multitude of products—furniture, TV antennas, appliances, utensils, photographic equipment, luggage, sporting goods, ladders, housewares, and so on. The 48 firms that make up this group perform more finishing operations than the average for the other groups.

Solvent cleaning was reported by 70% of the plants; polishing by 60%; spray painting by 47%, grinding by 46%; buffing by 46%; acid cleaning by 33%; barrel tumbling by 30%; caustic etching by 30%; and clear lacquering by 30%. Only four of these firms buy precoated sheet or coil.

Selecting one example, a Connecticut concern that manufactures portable tools reported that it does solvent cleaning, alkaline cleaning, acid cleaning, electrocleaning, vapor degreasing, grinding, polishing, buffing, barrel tumbling, conversion coating, bright dipping, sulfuric acid anodizing, spray painting, dip painting, and clear lacquering. This firm cannot be considered typical, but this shows the extent of finishing operations among some plants that handle aluminum.

A firm that produces luggage carriers for autos does only polishing and buffing at present, but intends to add a bright dipping installation, and volunteered the information that "we are most interested in knowing more about aluminum finishing, anodizing, polishing."

Some Big Outfits

The group identified as "commercial and industrial equipment" includes firms that make everything from valves, fittings, and hardware to office machines, materials handling items, hospital equipment, compressors, air tools, and irrigation pipe. Generally, they do not do as much in the cleaning and finishing line as do other groups.

Both grinding and polishing were mentioned by 60% of the 36 plants in this group. Solvent cleaning was reported by 52%; buffing by 51%; spray painting by 51%; alkaline cleaning and barrel tumbling by 36% each; and vapor degreasing by 30%.

Many of these plants do no more than clean and polish. On the other hand, a well-known maker of office machines performs several cleaning operations, as well as grinding, polishing, buffing, barrel tumbling, etching, anodizing, electroplating, and spray painting.

The group of plants that we arbitrarily classified as "miscellaneous" (because there were not enough of one type to make a good sized category) includes plants of some of the largest corporations in the country—Westinghouse, General Electric, Douglas Aircraft, General Motors and the like. As might be expected, these 35 plants have very large finishing departments.

Most of the plants that reported finishing operations on magnesium and titanium were also in this group.

Fully 85% clean aluminum with solvents, while 82% apply organic coatings by spray methods. Polishing and buffing were reported by 71%; alkaline cleaning and grinding by 70%; vapor degreasing by 64%; acid cleaning by 58%; caustic etching by 44%; clear lacquering, bright dipping and barrel tumbling by 41%; abrasive blasting by 35%; and electrocleaning by 35%.

An Electronics Firm

As an example, a large electronics firm in Maryland performs all major cleaning and mechanical finishing operations on aluminum, as well as etching, bright dipping, hard coat anodizing, spray painting, dip painting and clear lacquering. An aircraft firm (not the one mentioned above) does all of these and conversion coating, electroplating and plastic laminating as well.

The final group, the aluminum finishing firms, is made up mostly of job shop anodizers and electroplaters. Several roll coaters are included, as well. To nobody's surprise, these 33 plants perform a greater variety of aluminum finishing operations than any other group.

Over 80% of them perform some type of anodizing operation, for example. Fully 94% clean aluminum in alkaline baths, while 73% use acid cleaners. Bright dipping is done by 79%; caustic etching by 76%; and polishing and buffing by 58%. The same number apply conversion coatings to aluminum, but very few do any type of organic coating. Surprisingly enough, a few of the anodizing shops buy prepainted coil aluminum.

The surprisingly large response to our questionnaire is, we think, convincing proof of the widespread interest in aluminum finishing methods. On the following pages you'll find our summary of the procedures, equipment and materials needed to finish aluminum.

In gathering this information, we became more convinced than ever that there is a great opportunity for the company that can come up with new and better finishes for aluminum.

ALUMINUM FINISHING SURVEY RESULTS

Number of questionnaires sent	940
Number of replies	406
Percentage return	43%
Firms doing no aluminum finishing	79
Firms doing some aluminum finishing	187
Firms doing all aluminum finishing	140

The 327 firms that reported doing some or all of their own aluminum finishing perform the following operations:

Operation	*No. of Plants*
Solvent cleaning	191
Alkaline cleaning	166
Acid cleaning	126
Electrocleaning	33
Vapor degreasing	124
Grinding	164
Polishing	183
Buffing	184
Barrel tumbling	91
Abrasive (or vapor) blasting	61
Embossing	30
Caustic etching	144
Conversion coating	63
Bright dipping	97
Sulfuric acid anodizing	101
Chromic acid anodizing	52
Hard coat anodizing	33
Alzak	1
Electropolishing	12
Electroplating	36
Spray painting	155
Dip painting	41
Roll-coat painting	34
Clear lacquering	110
Plastic laminating	18
Porcelain enameling	10
Purchase precoated aluminum coil or sheet	61

a new, mproved ALODINE for aluminum

Cost Saving, Time Saving ALODINE 1200S Pre-Paint Treatment Protects Aluminum Best!

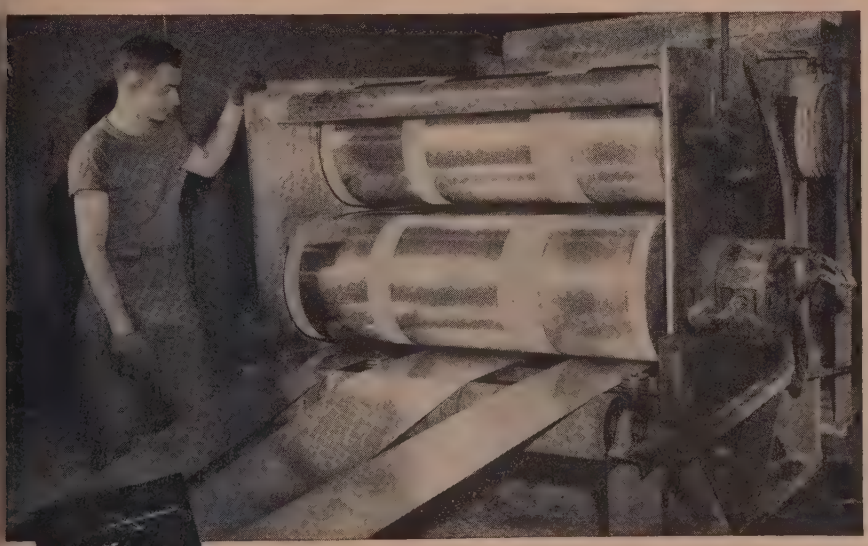
N LESS TIME—ALODINE 1200S provides increased hemical activity for dramatic reduction in processing time . . . up to 50% in most cases! You get ar faster processing than ever before, with the ame high quality protection!

VITH LESS EQUIPMENT—You can install an ALODINE 1200S system quickly and conveniently, *vithout resorting to mechanical bath maintenance!* That means no dangerous, time consuming checkng routines with the possibility of bath contamiion always present!

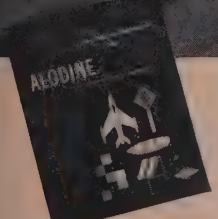
AT LESS COST—ALODINE 1200S can be processed hrough continuous dip in the same time cycle other conversion coatings require for continuous spray lines! This dip technique reduces initial equipment costs, slashes maintenance costs to a ninimum and allows aluminum fabricators to utiize conversion coatings more frequently for a wider range of product applications! Whatever the application method—brush, dip, continuous strip or spray—ALODINE 1200S may be the answer to your production problems.

FOR MORE FLEXIBILITY—Most important, its ease of operation, safety in use and versatility enables ALODINE 1200S to answer one of the most perplexing problems inherent in providing corrosion protection and paint bonding qualities for aluminum—the problem of constant, uniform quality. ALODINE 1200S is qualified under Government Specification MIL-C-5541.

Investigate cost saving, time saving ALODINE 1200S today! And whenever you have a chemical finishing requirement for aluminum—any type of aluminum—there's an ALODINE process available to protect or decorate the metal, and anchor the paint finish more securely.



Typical ALODINE 1200S strip line installation at ALSCO, INC. Strip from aluminum coil is fed into Alodine processing baths where it is cleaned, rinsed, deoxidized, rinsed, coated with ALODINE 1200S, rinsed and given a final acidulated rinse. Strip is then rewound, roll coat painted, roller formed into final shape, backed, inspected and packed for final shipment.



Write for Bulletin 1424A describing use of Alodine for aluminum fabrications of all types.

AMCHEM

ALODINE 1200S

another chemical development of **AMCHEM PRODUCTS, INC., Ambler 24, Pa.**
(Formerly American Chemical Paint Co.)

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WHEN CLEANING ALUMINUM...

you can use solvent cleaners—emulsifiable solvents—emulsion cleaners—hot alkaline cleaners—etch-type alkaline solutions acid cleaners (deoxidizers)—solvent vapor degreasing (with or without spray or dip)—electrocleaning—ultrasonic cleaning

CASE HISTORY: Prepaint Cleaning Aluminum Boats

Aluminum boats made by the Texas Boat Manufacturing Co., Lewisville, Texas, receive a cleaning, conversion coating and painting treatment that stoutly resists the corrosive attack of sea water as well as fresh water. The entire system is conveyorized for maximum output and uniformity of finish.

After being tested for leaks, boats are hung on a conveyor that carries them at a rate of 2.5 ft. per min. through a 4-stage washing and conversion coating machine (shown above). Here they are sprayed with a hot (140°F) alkaline wash solution made up of 1½ ounces of Oakite Composition No. 161 per gallon of water. The solution is sprayed on by two sets of headers spaced 18 inches apart. Solution is held in a 700 gallon steel tank and is fed to the spray heads by one Deming Fig. 4011 standard centrifugal pump. Cleaner removes all soil.

Next stage is a water spray rinse, delivered by three sets of spray heads spaced 18 inches apart and fed by another centrifugal pump.

In third stage, two sets of spray heads apply a solution of Oakite Chromicoat (1 ounce per gallon, room temperature), a chromate type conversion coating that enhances aluminum's corrosion resistance and provides a tight bond for paint. The Deming pump that feeds this spray phase is fitted with a stainless steel liquid end. The 700-gallon tank is also stainless steel throughout.

Fourth stage is a thorough water rinse applied by three sets of spray heads, after which the boats pass through a gas-fired, forced-air drying oven. Boats then receive paint job consisting of two sprayed coats of acrylic enamel, each baked on in an infra-red oven. Conveyor fixtures permit boats to be pivoted 360 degrees for painting of all surfaces.

Texas Boat Manufacturing produced nearly 5000 aluminum outboard boats last year. The company's "Texas Maid Fleet" consists of 14-foot and 16-foot runabouts and 18-foot cruisers.

CLEANING is the most commo operation employed in the pro essing of aluminum. Whether the sta ing material is sheet, plate, extrusio tube, casting, rod, bar, wire, forging foil, it will probably have to be cleane at least once during its transformatio into a finished end product.

The results of Modern Metals' Su vey on Finishing (see page 35) bear o this fact. Of the 327 respondents wh do some or all of their own aluminu finishing, fully 83% perform some kin of cleaning operation. And of the 5 plants that did not report a cleanin operation, most do some sort of mechan cal finishing (grinding, polishing, bu ing, etc.) that usually does not requi precleaning.

Virtually all chemical, electro-chem cal, organic and inorganic finishes f aluminum require at least a chemical clean surface—i.e., no water brea when water is run over the surface. T type of cleaning operation perform depends upon many factors—type soil to be removed, size and configur tion of parts to be cleaned, requiremen of the final finish, and allowable co

What Kind of Dirt?

The most common contamina found on aluminum surfaces inclu oil, grease, wax, shop soil, flux residu metal dust, thick oxide film, moistu and plain dirt. Your finishing depa ment may be unfortunate enough encounter all or most of them on o part to be cleaned.

However, it is more likely to find thin film of oil or wax resulting fr metalworking lubricants, coolants protective grease. Total removal of t film is an absolute must if you are avoid costly rejects at the end of finishing cycle.

Removal can be accomplished by number of means, though no clean system is universal or foolproof. Th finishing foreman is continually stalk by such hazards as water supply

what are the holes for?

These openings can provide floatation and serve as conduit for heat, coolants, gas, air, fluids, and wiring. Also this material is light, strong, decorative, leak proof, and highly conductive. When you're designing or developing new products consider the possibilities of Roll-Bond. Your inquiry will bring you free preliminary analysis of Roll-Bond in your application and a free illustrated booklet explaining Roll-Bond in more detail. Contact Olin Mathieson today: Metals Division, Roll-Bond Products, East Alton, Ill.

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ROLL-BOND
PRODUCTS

"inflated"
aluminum sheet

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Producers of: Roll-Bond, Western Brass and Olin Aluminum

PROPRIETARY CLEANERS FOR ALUMINUM

Name and Company	For Removing	Method	Temperature
ALKALINE			
Amchem Products, Inc., Ambler, Pa.			
Ridoline 50	oil, grease, dirt, shop soil	spray	160-180°F
Ridoline 53	"	soak	"
Diversey Corp., Chicago 13			
Diversey No. 36, 808, 909	oil, draw & buff compounds	soak	120-200°F
No. 17	oil, grease dirt, etc.	soak	160° Max.
No. 519	ink, draw & buff compound	spray	160-180°
Enthone Inc., New Haven, Conn.			
NE 6	oil, grease, ink, shop soil	soak	180°F
Frederick Gumm Chemical Corp., Kearny, N. J.			
Clepo 86-P	dirt, oil, lettering buff compound	soak	160-180°F
Clepo 85-AN	"	spray	140-180°F
Hanson-Van Winkle-Munning, Matawan, N. J.			
Mat 20 & 20W	oil, buff compounds, inks	dip, spray	140-200°F
Kelite Corp., Los Angeles 12			
Kelite No. 14	inks, dyes, stamp. & form. oils	soak	160-180°F
MacDermid Inc., Waterbury, Conn.			
Metex TS-40-A	heavy oils, buff compound, ink	soak	180-212°F
Metex S-413	light oils, buff compound	soak	140-180°F
Neilson Chemical Co., Detroit 20			
Emulsoprep 310-DA	"	soak	190-210°F
Northwest Chemical Co., Detroit 4			
Alkalume No. 13, 14, 22	light soils, ink, oil, grease	soak	150-200°F
Alkalume No. 2	drawing cmpd., soaps	spray	120-180°F
Oakite Products, Inc., New York 6			
Oakite 61, 61A	oil, grease, ink, shop soil	soak	hot
Oakite 161	"	spray	hot
Oakite Room-Temp	"	soak	70-100°F
Parker Rust Proof Co., Detroit 11			
Parko Cleaner 371 & 371A	oil, draw compounds, etc.	spray, soak	160-212°F
Parco Cleaner 352 & 352A	"	spray, soak	150-212°F
Pennsalt Chemicals Corp., Philadelphia 2			
Pennsalt A-27, A-28 & BC-51	inks, buff compounds, soils	soak	180-200°F
Pennsalt No. 62	general soils	spray	150-170°F
Wyandotte Chemical Co., Wyandotte, Mich.			
Altrex & Spray Altrex	oil, grease, ink, draw compounds	soak, spray	120-200°F
Alkaline, etch-type			
Amchem Products Inc., Ambler, Pa.			
Ridoline 15-F & 46A	oil, grease, dirt, draw lubricants,	spray, dip	150-200°F
Ridoline 62	"	spray	140-180°F
Diversey Corp., Chicago 13			
Aluminux No. 30	Thin films	soak	room to boiling
No. 202	oils, grease, inks	soak	150-190°F
Enthone Inc., New Haven, Conn.			
Etchalume 14	oil, grease, ink, shop soil	soak	
Frederick Gumm Chemical Corp., Kearny, N. J.			
Clepo 30R	surface oxides & etching	soak	130-160°F
Hanson-Van Winkle-Munning, Matawan, N. J.			
Mat 85-S	light soils, satin etch	soak	160-180°F
Macco Products Co., Chicago 20			
Macco K.V.S.	all types of soil	soak	boiling
MacDermid Inc., Waterbury, Conn.			
Metex No. 2	light oils, grease	soak	150-200°F
Neilson Chemical Co., Detroit 20			
Emulsoprep 314-DA	all soils	dip	120-180°F
Northwest Chemical Co., Detroit 4			
Alkalume "E"	oxidation-light soils	soak	75-180°F
Oakite Products, Inc., New York 6			
Oakite 30, 60 & 160	oil, grease, ink, shop soil, etc.	soak	
Parker Rust Proof Co., Detroit 11			
Parco Cleaner 310 & 311	oils, drawing comp'd, etc.	spray soak	160-212°F
Pennsalt Chemicals Corp., Philadelphia 2			
Pennsalt MC-1 & No. 85	general soils, oxides	soak	140-200°F
Pennsalt F-9	general soils, oxides	spray	150-160°F
Emulsion			
Amchem Products, Inc., Ambler, Pa.			
Ridosol 71	oil, grease, dirt, draw lubricants,	soak, spray	160°F
No. 16	general soil	soak, spray	140°F
Frederick Gumm Chemical Corp., Kearny, N. J.			
Clepo 8-S	oil, drawing, buffing compound	spray	120-140°F
Kelite Corp., Los Angeles 12			
Kelite Ke-Sonic	oil, grease, buff compounds, etc.	spray, soak	room to 160°F
Macco Products Co., Chicago 20			
Macco No. 378	all types of soil	spray	175°F
MacDermid Inc., Waterbury, Conn.			
Metex M-624	light oil, grease, buff compound	soak	160-180°F
Neilson Chemical Co., Detroit 20			
Emulsoprep 710-EC & 754-EC	all soils	spray, soak	150-180°F
Northwest Chemical Co., Detroit 4			
Alkalume A.C. No. 1	light soils	soak	170-180°F
Pennsalt Chemical Corp., Philadelphia 2			
Pennsalt EC-51 & EC-54	buffing compounds & general soils	spray	140-200°F
Wyandotte Chemical Co., Wyandotte, Mich.			
Nordall	machine oil, chips, dust	spray	120-180°F
Solvent (emulsifiable)			
Amchem Products, Inc., Ambler, Pa.			
Amchem Ridosol 250	heavy oil, grease, dirt, etc.	soak, spray	160°F
Frederick Gumm Chemical Corp., Kearny, N. J.			
Clepo 8-J	oil, drawing, buff compound	soak	cold
Hanson-Van Winkle-Munning Co., Matawan, N. J.			
Mat Solvent No. 2	heavy soils, grease, oils, buffing compounds, lubricant	soak	room
MacDermid, Inc., Waterbury, Conn.			
Solvmax X-15	oil, grease, shop soil	spray	160-180°F
Northwest Chemical Co., Detroit 4, Mich.			
Acid Solvent Emulsion No. 1	heavy soil	soak	160-190°F
Emulsion Cleaner No. 3	heavy soil	soak	80-140°F
Oakite Products, Inc., New York 6			
Oakite 7, 9, 11, & 18	oil, grease, buff compounds, etc.	soak	room
Oakite 8, 96, 98, 198	"	spray	room
Wyandotte Chemical Co., Wyandotte, Mich.			
Wyandotte 468	draw & buff compound, oils	soak	room or higher

dubious content, temperamental eq ment, human frailties, and the like. is well advised to set up — and follo a quality control system. Manufactu of the finishing materials and equipm he is using can offer the best advice this matter.

Cleaners: 3 Basic Types

Cleaners for aluminum fall into th broad categories — solvent, alkaline acid — and there are subdivisions wit these groups. (Most of the well-kn proprietary aluminum cleaners listed in the table at left.) Ap cation methods run the gamut from primitive brush or mop to elabo multi-station, automatic cleaning pla

If your workpiece is a soiled airpl you'll probably have to hose or s it down by hand. If you're dealing half a million stampings that have be color anodized, you'll probably n automatic or conveyorized system.

A brush soaked in petroleum-base chlorinated solvent is the most r mentary (and least effective) clean method. Your worker is more likel spread a thin film of grease over the tire part, and the fumes may knock out. This method is not recommen

Nor is it a good idea to dip y aluminum parts into a tankful of p solvent. Your parts will pick up a t film of grease from the surface as t are removed from the tank. Also, open tank of solvent is a serious hazard.

Good Grease Killers

If you're working with solvent cl ers — and they're hard to beat as gr killers — it's best to use a vapor greasing system (described later) or of the emulsifiable solvents, or both. the name implies, the emulsifiable vents are solutions of solvents cont ing one or more emulsifiers. Propriet solutions are usually compounded to diluted with kerosene or another vent. Some are used as-received.

Application is usually by soak ta Parts to be cleaned are dipped in tank for a short period, then remo and drained. When the part is expo to a water spray, an oil-in-water em sion is formed and rinsed off. A li film of oil often remains, howe and this is best removed by vapor greasing or cleaning with an alka solution.

Be careful with emulsion clean Some of them are volatile, so prec tions against fire are advisable. Ot cleaners of this type are based on v tile chlorinated hydrocarbons, wh eliminates the fire hazard. The fu are toxic, however, so the clean facility should be well ventilated.

Most of the emulsifiable solvent ba

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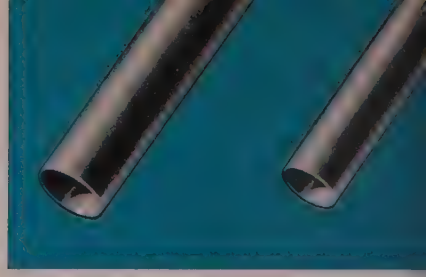
HOW ABOUT IT?

SEE OTHER SIDE



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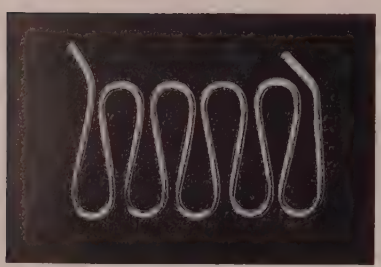
WOLVERINE ALUMINUM

In Wolverine Tube you have an aluminum source with years of metalworking experience — one which places top emphasis on product quality and service reliability.

Wolverine produces both drawn and extruded aluminum tube as well as extruded aluminum shapes. The Company also maintains complete fabrication facilities.

Wolverine tubing and shapes are manufactured in the following alloys: EC; 1100; 3003; 6061; 6062; 6063. Drawn aluminum tube is available in sizes from ⅛ inch through 2 inches O.D. Extruded aluminum tube is available in sizes from ¼ inch through 3 inches O.D.

We're sure you'll appreciate Wolverine's product quality and service reliability. May we have your next order? Write, too, for the Wolverine Aluminum Catalog. It is one of the most complete available . . . anywhere.



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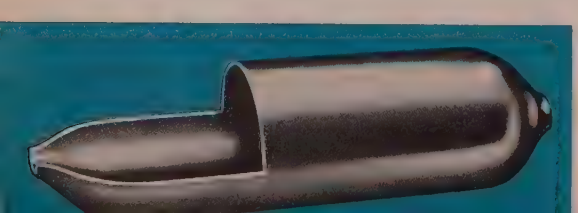
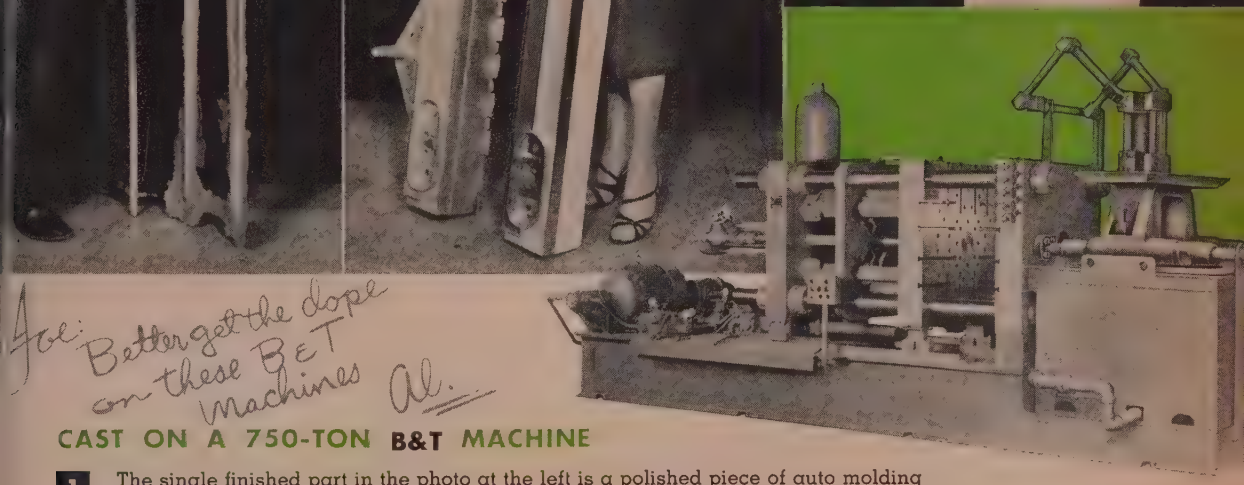


PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA.
SALES OFFICES IN PRINCIPAL CITIES

HOLLAND DIE CASTING COMPANY, with skill and experience, produces extraordinary castings on B&T DIE CASTING MACHINES!



CAST ON A 750-TON B&T MACHINE

1 The single finished part in the photo at the left is a polished piece of auto molding trim 64 inches long. It is produced in a two-cavity die weighing more than 8500 lbs. and measuring 84 inches in length. Weight of shot is 10½ lbs. Platens on the B&T machine are 48 inches wide and thus the 84 inch long die actually extends 1½ feet beyond each side of the machine. In successfully holding and casting this long piece the B&T 4-toggle lock-up system forcefully demonstrates its remarkable efficiency.

CAST ON A 750-TON B&T MACHINE

2 This intricate casting is the console of an automatic washing machine. The shot required weighs 14 lbs. Six 5 inch mounting studs in the back of the part are cast independently of the wall. The console has intricate coring and the instrument cluster is chrome plated and painted . . . a difficult casting to produce.

CAST ON A 600-TON B&T DIE CASTING MACHINE

3 This triangular-shaped casting is a chrome plated gravel guard for one of America's finest cars. It is made by the Holland Die Casting Company in a single cavity die weighing more than 6,000 lbs. Weight of the shot is 6½ lbs. Finish obtained is excellent. An outstanding production job for a 600-ton machine and indicative of the remarkable results obtainable with all B&T machines. Holland Die Casting Company's facilities include 12 B&T die casting machines in capacities up to 1,000 tons.

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are maintained by simply adding more solution. Since most of the soil is emulsified and removed during the rinse cycle, accumulation of sludge in the tank is cut down. Some sludge is bound to build up, however, and it's a good idea to remove it periodically.

Emulsion Cleaners Used Hot

Emulsion cleaners also combine solvents with emulsifiers, but they are compounded to be diluted with water rather than solvent. This eliminates the fire hazard — unless the emulsion is unstable, resulting in a layer of solvent on the surface of the bath.

Emulsion cleaners are usually used hot, sometimes in conjunction with alkaline cleaners. Application is generally by immersion of the parts to be cleaned. Bath composition is anywhere from four to eight ounces of cleaner per gallon of water. Bath is maintained by adding water and cleaner as needed.

One manufacturer recommends that its emulsion cleaner be used in conventional equipment at a concentration of 10 to 25% by volume in water. Bath temperature ranges from 160° to 190°F, and cleaning time depends upon the nature of soil to be removed and temperature of the bath.

Emulsion cleaners are occasionally used in pressure spray washing equipment. In these cases, the concentration is usually cut down to one-half to one ounce of cleaner per gallon of water.

Probably the most common aluminum cleaning procedure is the familiar hot alkaline bath. These non-etching cleaners are generally made up of weak alkalis such as sodium carbonate and tri-sodium phosphate, with a concentration of four to six ounces of cleaner per gallon of water. Most proprietary formulations (see page 40) also contain inhibitors such as sodium silicate to prevent etching of the aluminum.

A bath run at 160-190°F. will usually remove light grease or oil films, loose dirt and chips and the like in 10 minutes or less. The action is usually fourfold: Wetting action on all surface contaminants; fatty acids are saponified; other oils or greases are emulsified; and non-oily materials are taken into solution.

Spray Cleaning Faster

Although the soak tank is the most common vehicle for these solutions, agitation greatly augments their speed and effectiveness. If your volume is high enough, a pressure spray wash installation is well worth considering. It may quickly pay for itself in time savings. Whether the cleaner is applied by brush, dip or spray, it should be followed by a thorough rinse in running hot water.

Tanks for most of the proprietary solutions may be made of mild steel. (Some manufacturers recommend stainless steel tanks if the parts are to be plated.) Heating coils, too, can be of steel. Since fumes are non-toxic, venting of water vapor can be accomplished by normal exhaust systems.

Most suppliers recommend their non-etching alkaline cleaners for use prior to anodizing or the application of conversion coatings or organic and electroplated finishes.

Some alkaline cleaners are compounded to produce a light etch on the surface of the aluminum cleaned. These cleaners usually contain caustic soda plus phosphates, carbonates and surfactants. Most proprietary compounds also have special additives to prevent formation of scale on tanks and heating coils.

The primary purpose of these materials is cleaning, not etching. The etch produced is not as uniform or as bright as the decorative "frosted" finish produced by caustic etching (see Chemical Finishing, page 64).

One manufacturer of etch-type alkaline cleaners reports that the material is used in a concentration of one ounce per gallon of water for the cleaning and mild etching of aluminum collapsible tubes prior to lithographing or lacquering. The barely perceptible etch apparently provides "tooth" to hold the inks and lacquer.

Acid cleaners are more accurately classified as deoxidizers, and are most commonly used to prepare aluminum for resistance welding. Sometimes they are used prior to anodizing or caustic etching. Unlike alkaline solutions, they require more costly corrosion resistant tanks and other equipment.

Acid for Pre-Weld

Acid baths may be of several types. The phosphoric variety consists of about 10% of 85% phosphoric acid, 40% of butyl alcohol, and 30% of isopropyl alcohol, the balance water. A wetting agent may also be added. This type of bath will remove light oxide films and leave an inert film of aluminum phosphate that resists moisture and promotes paint adhesion. (Most authorities recommend conversion coating for paint adhesion, however.)

A bath made up of chromic acid or various chromates plus an acid salt is another common formulation. Deoxidizing of aluminum is also accomplished in a bath made up of silicofluoride or some other complex fluoride dissolved in a combination acid solution.

Special acid solutions may be made up to remove specific soils from aluminum. For example, heat treat films, water stains, and burnt-in oil stains will disappear in solutions of sulfuric acid and chromic acid. A combination of nitric and hydrofluoric acids will remove most welding and brazing fluxe

Acid baths are not recommended fo removing oils or grease. In fact, th pre-weld treatment is often a two-stag affair in which the deoxidizing acid di is preceded by a cleaning step to remov oil, grease, ink, dirt, etc.

If exceptionally heavy oxide films a present on the aluminum surface to b welded, it may be necessary to use more aggressive dip such as a 5% causti soda solution. This is usually followe by a dip in 20 to 50% nitric acid solu tion to remove the smut that build up in the caustic bath and to neutrali any alkali remaining on the surface.

Vapor Dissolves Grease

Vapor degreasing with chlorinate organic solvents is an excellent metho of removing organic soils such as oi grease, wax, and the like. Properly pe formed, it produces a truly grease-fre surface for subsequent finishing. (I very thick or highly viscous coatings o grease are present, however, it may b more efficient to start with solvent clea ing, followed by vapor degreasing.)

The growing popularity of vapor d greasing is born out by the results o Modern Metals' recent finishing su vey. Of the 327 firms that do all or som of their own aluminum finishing, 12 employ vapor degreasing. In almost a cases, these plants perform other type of cleaning as well.

The basic principles of vapor degrea ing are simple enough. The parts to b cleaned are immersed in the heate vapors of a chlorinated solvent such a trichlorethylene or perchlorethylene. A the vapor condenses on the cooler part it dissolves and carries off any grease o oil on the surface.

What's a Degreaser?

The degreaser itself is basically thermo-balanced still, usually enclose in a rectangular steel tank (see dra ing on page 46). From bottom to top, consists of: A boiling tank with sui able provision for heating; a vapor are (this is where degreasing takes place a vapor level control (essentially wate coils); and a freeboard zone above th cooling coils.

As the drawing shows, there is al a water separator, a thermostat, and condensing trough. Most degreasers al contain a solvent storage tank. If spra degreasing is combined with the vap phase, the unit will also include a spra lance and a spray pump. Heat may b provided by steam coils, electric hea ing elements, or gas burners. The mo ern trend is toward electric heaters.

The degreaser is operated as follow Solvent is admitted to the boiling tan to a depth of 3 or 4 inches above th

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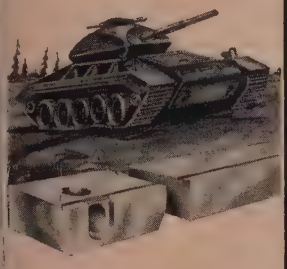

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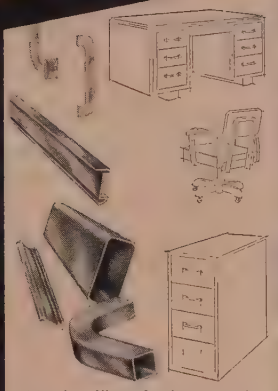

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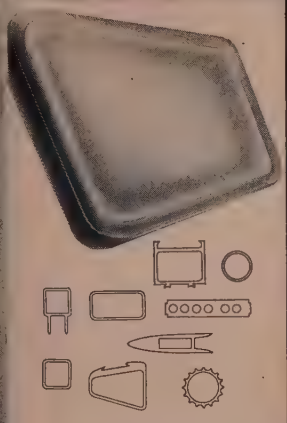

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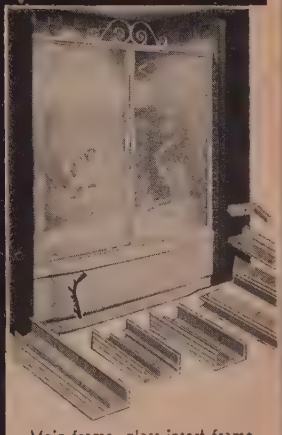

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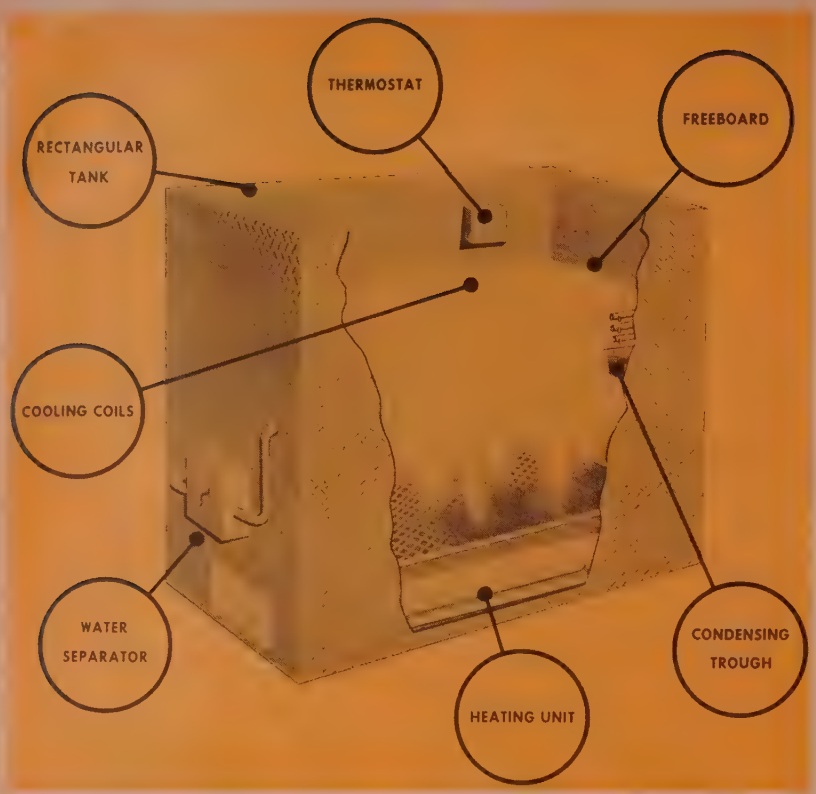

Vapor Degreasing Ideal for Removing Organic Soils

Grease, oil, wax, buffing compounds and other organic-base contaminants are effectively removed from aluminum parts and assemblies by vapor degreasing. This schematic drawing shows principal features of a typical vapor degreaser. Fumes of chlorinated solvent such as perchlorethylene condense on parts suspended in degreasing zone; dissolve and carry off contaminants. Spray or dip degreasing are sometimes combined with vapor phase when particularly stubborn soil is to be removed.

heating elements and water is sent coursing through the cooling coils. The heat is turned on and as the solvent reaches its boiling point, a light vapor fills the area below the cooling coils. (If the unit is functioning properly, the vapor will not rise above these coils.)

A Simple Process

Parts to be degreased are usually placed in a basket made of wire or expanded metal. The basket is lowered into the vapor area and left there until condensation of vapor on parts is completed. The basket is then lifted out of the vapor area and allowed to hang for a while in the freeboard area so that any trapped solvent can drain back into the tank.

That's about all there is to it. If the equipment is functioning properly and the operation is correct, the parts will be completely free of oil or grease. Naturally, it is necessary to occasionally clean out the degreaser and reclaim the solvent. Equipment makers and solvent suppliers offer complete instruction on these matters.

Sometimes, the vapor phase may be combined with warm solvent spray or immersion in warm solvent or boiling solvent or both. Multiple phases are generally used when small parts are packed closely together, or where parts contain small crevices that may be inaccessible to vapor. They may also be necessary when several types of soil are to be removed or when tightly packed buffing compound must be dislodged from minute crevices.

Trichlorethylene and perchlorethylene are the most widely used solvents. The former is easily the more popular because of its lower boiling point (189°F, compared with 250° for perchlor) plus the fact that it has been more vigorously promoted. The lower boiling point means that a lower pressure can be used in steam heated degreasers.

If you are planning to install vapor degreasing equipment, however, it would be wise to consider a system that would handle perchlorethylene's higher boiling point. Some authorities recommend perchlor for aluminum since chips or powder of the metal tend to cause decomposition of trichlor.

What's more, perchlor's higher boiling point gives you a longer cleaning period — an important consideration since aluminum tends to warm up to vapor temperature more rapidly than other metals.

In either case, vapor degreasing will produce a really grease-free surface for subsequent finishing. Its higher cost may well be more than recovered in reduction of rejects — particularly if a costly finishing cycle is to follow cleaning.

There are various other methods of cleaning aluminum — electrocleaning and ultrasonic cleaning being the better-known ones — but the technique described above will handle most requirements.

Electroclean Electroplates

Electrocleaning is not widely used on aluminum, as indicated by Modern Metals' finishing survey. Of the 32 firms that do all or some of their own aluminum finishing, only 33 reported electrocleaning operations. When it is used, electrocleaning is generally used to clean intermediate electroplates during the plating of aluminum.

A hot alkaline solution serves as the electrolyte, and the aluminum parts are the cathode. A 6- to 12-volt current is passed through the solution for a few minutes (depending upon extent of contamination), after which the current is reversed for a few seconds. Reversing the current clears the tarnish from aluminum surfaces.

Cleaned parts are then rinsed in hot water, dipped into an acid bath to neutralize any remaining alkali, then rinsed in cold water.

Scrubbing With Sound

Ultrasonic cleaning is probably the most sophisticated (and costly) method of cleaning aluminum. In this method extremely high frequency sound waves are transmitted through a fluid medium (trichlorethylene, for example) in which the parts to be cleaned are immersed.

When the sound waves strike the workpiece, millions of tiny vapor bubbles are instantly formed and collapsed. The impact of these implosions against the work surface carries enough force to dislodge the most tightly adherent film of grease or other contaminants.

The method is particularly good for removing buffing compounds and other impacted solids without disturbing the metal surface, and it is claimed to produce the cleanest surfaces possible. Its extremely fast action makes up, in part, for the high cost and relatively small size of ultrasonic cleaning units.

A number of firms are now producing ultrasonic cleaning equipment, and the size and adapability of these units are growing fast. The method is still expensive, however, so the requirement of the parts to be cleaned and the total finishing cycle must justify the cost.

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Armour's technique is a variation of an ancient process called repousse. A sheet of aluminum is positioned over a steel pattern block, into which a design has been tooled in reverse. Using a metalsmith's hammer, the craftsman pounds the aluminum into the steel pattern. The aluminum sheet thereby takes on the desired pattern, down to the most minute detail, in bas relief.

The back side of the sheet — the one that is hammered — takes on a continuous hammered surface consisting of hundreds of overlapping shallow depressions. The hammered pattern is also faintly discernible on the face side, along with the bas relief design.

The sheet is then straightened and cut to size; the edges are finished off; and the product is formed by hand into the desired shape. The final touch that distinguishes Armour's aluminum ware is a quiet antique finish that is applied by the simplest of methods.

First, the surface is cleaned and brought to a uniform texture by the use of a fine abrasive. Then the piece is given its luxurious coloring by holding it in a soft coal fire, after which it is polished with fine steel wool and wax. The final polishing removes some of the charcoal-colored patina from the high spots, but not from the deeper depressions. The result is a pleasing pattern, highlighted by the contrast of buffed aluminum against the deep, near-black patina.

Arthur Armour's technique exemplifies the broad range of unusual effects that can be achieved in aluminum with mechanical finishing methods. More than any other general class of surface conditioning processes, mechanical finishing exploits the innate beauty of aluminum. It is also the most common type, as indicated by replies to Modern Metals' finishing survey. Of the 327 respondents who do at least some of their own aluminum finishing, 249 perform one or more mechanical finishing operations.

Polishing and buffing operations were reported by 183 and 184 firms, respectively. Grinding is done by 164 firms; barrel tumbling by 91; abrasive (or vapor) blasting by 61; and embossing of aluminum by 30 firms. Of course, most of these plants perform several operations, the most common combination being polishing and buffing.

Mechanical Finishing Is . . .

A satisfactory definition of mechanical finishing is hard to find. Generally speaking, it encompasses any of the non-chemical means of altering the texture of the metal surface, either as a final finish or as preparation for subsequent finishing. The action may be abrasive — as in grinding, polishing, buffing, sand blasting, etc. — in which case removal of metal is involved. Other processes such as embossing, hammering and shot blasting do not, as a rule, remove metal.

Aluminum can usually be finished with the same equipment and materials employed on other metals, but procedures are different in some cases. If you are just starting to process the metal, you will do well to remember that the surface of aluminum is softer and has a higher coefficient of friction than that of say, steel.

This means that you will usually need a lubricant in polishing and buffing operations, and that lower pressures will be necessary in grinding, polishing and buffing. (If aluminum is overheated during polishing, for example, some "dragging" or cutting-away at the grain boundaries may become evident.) Aluminum's softer surface should also be considered in operations such as abrasive blasting and barrel tumbling.

Grinding Mostly for Castings

Parts or components made of sheet, extrusions, or other wrought aluminum forms rarely require grinding. The exception may be a weldment in which the weld seam is to be blended into the surrounding area. Grinding is generally used to swiftly remove large defects, parting lines, and the like from aluminum castings.

Either rotary wheels or abrasive belts may be used to grind aluminum. Which to use depends largely upon the size and shape of the surface to be ground, equipment available, production requirements, etc.

If your part is too big to be held against the conventional floor or bench mounted grinding wheel, you will probably use portable air-powered rotary grinders fitted with cup grinding wheels. The wheel speed is usually on the order of 4500 rpm. Lubrication is rarely, however, used here. As in most mechanical finishing operations, the quality of the job depends on the operator's skill.

For other types of wheel grinding operations, phenolic-bonded wheels with grit size of 24 to 50 may be used. The abrasive may be either silicon carbide or aluminum oxide. Some experts recommend the latter — particularly if the part is to be anodized. Reason: Embedded particles of silicon carbide might discolor the work during anodizing.

In an increasing number of instances it is necessary or desirable to grind aluminum parts on large surface grinders such as the one illustrated on page 50. When surface grinding aluminum on such machines, a Bakelite-bonded silicon carbide abrasive wheel of medium hardness is often chosen for rough grinding at 6000 to 8000 sfpm.

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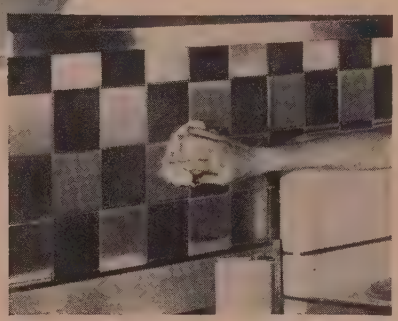

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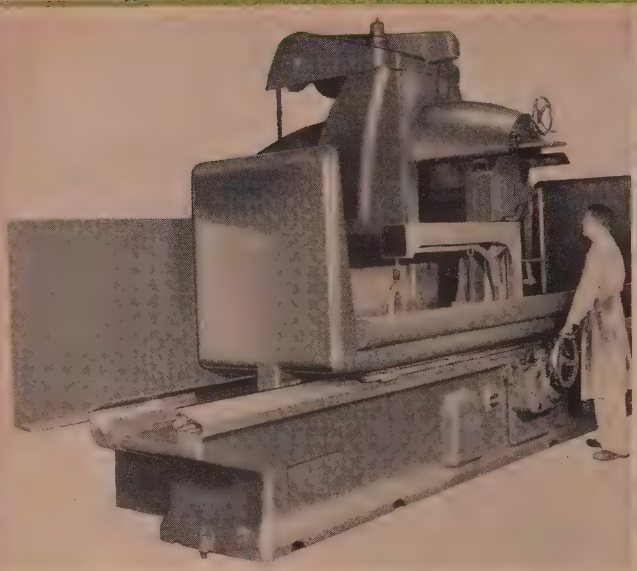

CASE HISTORY: Surface Grinding Aluminum Plane Angles

Large flat surfaces of aluminum plane angles and other light metal parts made by Machine Products Corp., Detroit, are often ground down smooth on this horizontal-spindle surface grinding machine built by Mattison Machine Works, Rockford, Ill. Rough grinding is often done with a medium-hard, Bakelite-bonded, silicon carbide wheel, run at 6000 to 8000 fpm. For finish grinding, a softer, vitrified-bonded wheel is run at a somewhat lower speed—generally under 7000 fpm. Proprietary coolants of the non-water base variety are usually used. The example shown here required a special height block, shown under the left end of the angle in the photo at left. A rope sling was used (right photo) to avoid damaging the part.

bond type, is generally chosen for finish grinding, and a somewhat slower surface speed is preferred; many operators do not go above a speed of 7000 fpm when finish grinding aluminum.

Although kerosene has often been used as a coolant when surface grinding aluminum, it is probably better to use one of the proprietary coolants that will not support combustion. Such compounds are particularly recommended when both aluminum and magnesium are to be ground on the same machines.

Special fixtures are often developed to prevent springing of thin walls when surface grinding some castings such as aluminum automotive housings. In cases where flat aluminum parts are to be surface ground, use can be made of the magnetic chuck by positioning the aluminum part flat on the chuck and placing steel pieces firmly against it at different positions.

The steel pieces are held firmly by the magnetic chuck, thus preventing movement of the aluminum piece. The steel pieces must be somewhat thinner than the aluminum part so they will not be engaged by the wheel.

When small aluminum parts are ground in quantity, steel rings may be used on the magnetic chuck for retaining them properly. In other cases, steel holding members with suitable notches cut into their edges can be used in pairs for holding aluminum parts of different shapes. Where none of these devices will work, special steel fixtures may be made to hold the part.

Consider Belt Grinding

Abrasive belt grinding and polishing are gaining favor among aluminum fabricators. These versatile machines can take abrasive belts of different grades for operations ranging from heavy stock removal to fairly fine polishing. Proprietary belt grinding machines of many designs and sizes are available from numerous machine manufacturers.

In some instances, belt grinding or polishing is combined with buffing in an indexing type of machine. Other combinations are built specifically for certain high-volume operations.

The operating principle is the same in nearly all of these machines. The endless abrasive belt is held in contact with the workpiece by a driven contact roll which is usually made of oil-resistant rubber. The roll can be varied in hardness and grooving (serrations in the periphery of the roll) to suit varying degrees of stock removal. In addition, of course, grit size on the abrasive belt will influence stock removal rate.

Generally, heavy stock removal calls for a harder roll with smaller grooving. The reverse is true where a finer finish is desired. A compromise between the two extremes may be used when one machine is to perform several operations ranging from grinding to polishing.

Some authorities on the subject advise against lubrication when rough grinding aluminum castings. You run the risk of driving some lubricant into the pores of the casting, they contend, and the stuff can be very difficult to remove in subsequent finishing operations. When lubrication is necessary, they recommend tallow or lard oil, used sparingly.

Another factor to watch carefully is wheel or belt speed. If it runs over 8000 fpm, you will probably overheat the work. Too slow a speed, on the other hand, may cause stripping of abrasive from the belt or wheel.

How to Polish

With a few exceptions, a mechanical abrading operation that follows grinding and precedes buffing is classified as polishing. The operation may provide the final finish, but usually prepares the metal surface for subsequent finishing such as buffing, anodizing, etc.

Polishing of aluminum may be accomplished with either wheels or abrasive belts, the choice depending upon the available equipment, contour of the surface to be polished, subsequent finish

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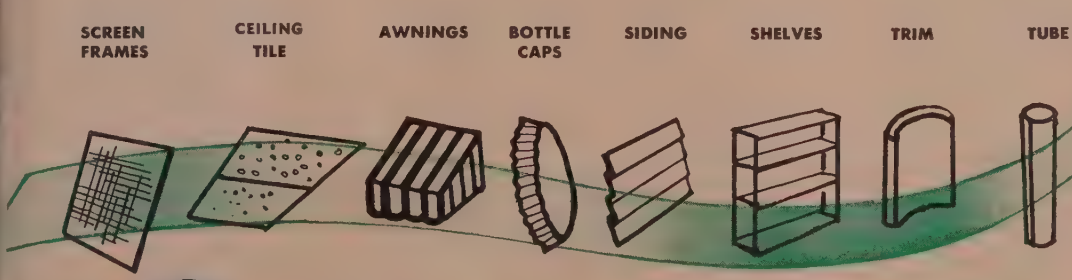

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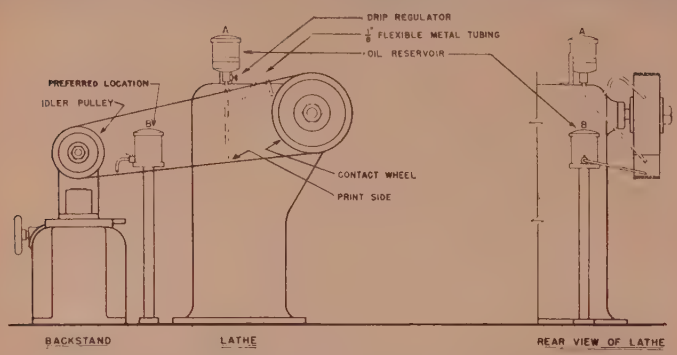
A simple oil drip setup for

LUBRICATING ABRASIVE BELTS



Being softer than many other metals, aluminum tends to load abrasive belts. This accumulation of aluminum particles in the abrasive surface reduces belt life and may cause scoring of the workpiece. One way to minimize loading is to oil the belt. Here's a simple but effective oil drip technique suggested by The Carborundum Co., Niagara Falls, N.Y., supplier of industrial abrasives:

1. Install an oil reservoir to feed by gravity through a regulating valve to a quarter-inch flexible metal tube which leads either to the exposed rear portion of the contact wheel or to the print side of the belt (see drawing above). The reservoir may be mounted on the lathe as shown at "A" or separately as in "B."

2. Immerse belt to be used in prescribed type of oil for about five minutes, then drain off excess oil.

3. Put belt on machine and start machine.

4. While machine is running, carefully apply oil with brush to exposed rear portion of contact wheel to saturate wheel surface.

5. Turn on oil drip and adjust rate to about one drop every ten seconds. Once in operation, this method requires little attention. The oil penetrates the belt from the back or print side and is forced to the grit side by centrifugal force and capillary action.

The lubricant may consist of 30% lard oil and 70% mineralized cutting oil or other high flash point oil. If you're using resin bond belts, add a small amount of butyl stearate (1% or 2% by volume) to the lubricant. This acts as a wetting agent, permitting the oil to penetrate the belt. Also, make sure that the contact wheel is of oil resistant material.

Fire is not a serious hazard with this setup, but it's best to observe the usual safety precautions. Heavy accumulation of oil in the exhaust system could cause trouble.

Properly installed, the oil drip setup should give you faster cutting action, more metal removal per belt, and improved surface finish. Aluminum parts that have been processed on oiled belts generally need to be degreased before anodizing, conversion coating, etc.

ing operations, and personal preference. Wheels are probably the most commonly used medium, but the abrasive belt is gaining favor — particularly for processing extruded shapes.

Roughing is a transitional polishing operation that is rarely used on wrought aluminum products (except, perhaps, forgings), but is often required to remove deep scratches or gross irregularities from the surfaces of sand castings. It may also be used to salvage articles that have been damaged in fabrication.

If your operation does require roughing, you will probably use a cemented muslin or canvas wheel coated with a coarse abrasive (50 to 100 grit), and run at a peripheral speed of around 6000 fpm. Other types of wheels include wood discs covered with felt, flannel, sheepskin or leather. These are inflexible, however, and not recommended where curved surfaces are to be polished. Overheating may be avoided by applying small amounts of tallow or lard oil. It's best not to lubricate during roughing, however.

Your aluminum polishing operation is more likely to be of the "greasing" or "oiling" variety. In this case you will use a softer wheel (muslin or soft felt); a finer abrasive (100 to 200 grit); a lubricant (tallow, oil, beeswax, or proprietary compound); and a peripheral speed of around 6000 fpm.

A soft felt wheel is preferred because it contains no sewed or cemented seam to score the work. Felt generally costs more than muslin, but it offers the advantage of uniform density, plus the fact that it can be shaped to fit contoured shapes.

Lubrication is very important. If overheating evaporates the lubricant, particles of aluminum may build up on the wheel. Result: Deep scratches the workpiece. Many excellent propr tary polishing and buffing compour are available. Most of them are sold solid (stick) form, but liquid lub cants are growing more popular more and more manufacturers inst automatic polishing and buffing m chines. These compounds are a used in buffing operations, which dealt with later on.

The abrasive belt is also used polishing aluminum — particularly trusions or other parts that have la or extended flat surfaces. An importa advantage of abrasive belt polishing the speed of operation. The belt off a much larger abrasive area than y can get with a wheel, and there is l danger of overheating the part. Al you can often get more mileage out the abrasive.

Design and construction of the co tact wheel have a strong effect on b polishing results. Though a hard whe gives a faster cut, it also yields a coar finish than you would get with a soft wheel and the same belt. Serratio (notches in the face of the wheel) a influence rate of cut and life-span the belt. For most operations on alur num, the serrations should be at a degree angle to the side of the whe

For most roughing operations, a s rated rubber contact wheel with Durometer "A" rating of 20 to 100 w do the job. The belt should be 50 100 grit. For greasing or oiling ope tions, use a rubber wheel (20 to "A" Durometer) with serrated face a equally spaced circumferential slits. F a finer finish, use a smooth faced ru ber wheel. Grit size in the belt m range from 100 to 220.

You Should Lubricate

As in wheel polishing, lubrication very important — especially if the wo is to be anodized. The lubricant m be tallow, oil, beeswax, or one of t proprietary compounds. If wet b polishing is to be used (to hold te perature down) be sure your abrasi belt is bonded with a waterproof a hesive. Cloth-backed belts are best f most operations.

If contoured shapes are to be p ished on the abrasive belt, the conta wheel must either have sufficient "giv to accommodate the contour, or mu be shaped to the contour. A wheel ma of canvas can be shaped to the appr priate contour, or solid or section buffs may be used for this purpo Solid buffs may be bought in standa wheel widths and in densities fro medium to extra soft.

It has been reported that parts wi convex surfaces can sometimes be p ished by holding them against the sla

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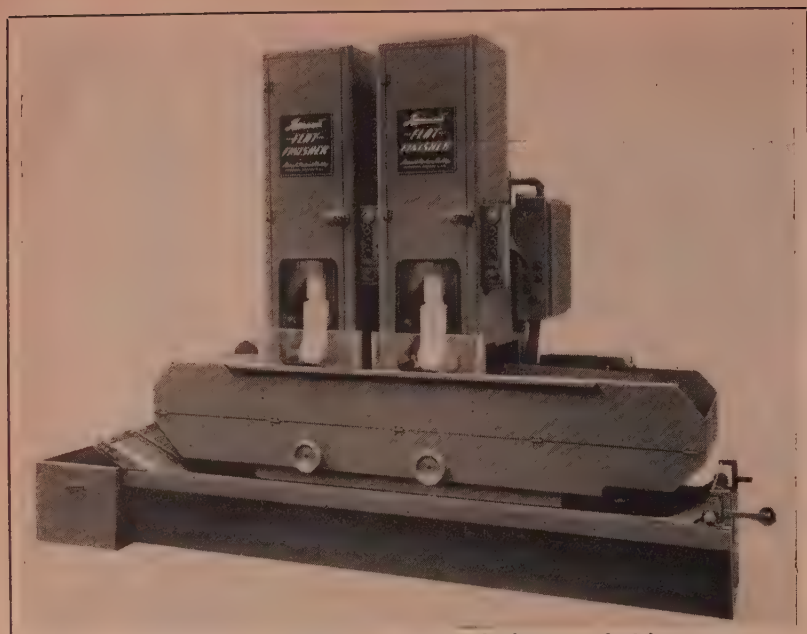

Abrasive Belt Grinding and Polishing of Aluminum

More and more aluminum firms are performing their grinding and polishing work on special abrasive belt grinding machines such as this double-head unit made by Hammond Machinery Builders, Inc., Kalamazoo, Mich. In instances where large, flat work requires a uniform finish, machines such as this are especially effective. Multi-head arrangements can combine successive grit operations for fine finishes or the same grit belt on each head for maximum stock removal.

This Hammond Flat Finisher takes belts measuring 12 inches wide, 126 inches long; features two roll head design, air tensioning on head belts and conveyor belt, depth of cut controlled in .001-inch increments; multi-V-belt drive, work pressure ammeters on each head, variable speed conveyor drive from 0 to 60 fpm. Abrasive belt speed is 2-6000 sfpm.

of the belt. If irregular concave surfaces are involved, however, normal wheel polishing will probably have to be used.

When Buffing Aluminum . . .

Your workman's skill is vital to the success of nearly all mechanical finishing operations, but nowhere is this factor more critical than in buffing. Proper selection of compound, buff and wheel speed can all go for naught if the worker's technique is faulty. Mechanized buffing helps avoid human error, but machine setup also call for skill.

The purpose of buffing is to give the metal a high luster, sometimes approximating a mirror finish. It may be the final finish (except for clean, rinse and dry) or it may be followed by anodizing, lacquering, etc.

Buffing is usually divided into two stages: 1) cutting down; and 2) coloring. The first stage involves some slight metal removal, but coloring is generally a flowing action rather than abrasion. It does not actually alter the hue of the metal, but imparts a characteristic gloss. The part is usually cleaned — with petroleum-base solvent, for example—between the cutting down and coloring operations.

Soft buffs and fine abrasives of varying types are used for cutting down and coloring. Most of the buffs are made of muslin sheet. Sewed buffs, usually with spiral seams, are most commonly used in the cutting down operation. The closer the seams, the harder the buff and the faster the cutting down action. For coloring, looser buffs with less cutting action are used. A string buff with no stitching except around the arbor hole is often used.

Tripoli, a soft silica-base compound, is the abrasive most commonly used in buffing aluminum. When combined with a grease base such as tallow, petrolatum or hydrogenated fatty acids, it forms a cake which is pressed against the revolving buffing wheel. Frictional heat softens the grease binder so that the buff can pick up abrasive. Many excellent proprietary buffing compounds for aluminum are available.

Wheel speeds used for buffing can be higher than those specified for polishing because of the lower heating effect. A peripheral speed of 7000-7500 fpm will do for the cut-down operation, while 7500-8000 fpm is recommended for coloring. If automatic buffing machines are used, wheel speeds can be even higher because contact pressure can be more accurately controlled than with manual buffing.

In automatic buffing operations, the compound is generally applied by spray. The abrasive is the same as in solid compounds, but it is suspended in a water emulsion or oil solution so that it may be sprayed onto the revolving buff by means of a conventional spray gun. In this case, the spray must be applied with sufficient pressure to penetrate the air turbulence created by the revolving buff.

Spray buffing not only gives better control by minimizing the human element, but also speeds production, conserves buffing compound, reduces buff wear, and often simplifies post-cleaning operations (an emulsion base compound is easier to remove). This method is becoming standard procedure where high volume polishing and buffing operations are involved.

Improper buffing procedures can cause a number of defects, the most common ones being surface roughness, cloudiness of the buffed surface, and pitting.

If clouding or pitting occurs in the cutting down operation, you may need a softer buff. Pitting may also be licked by using a lower melting point compound—but this may tend to cause clouding. Both pitting and clouding may result from excessive contact pressure or too high a peripheral speed.

Obviously, buffing is an art rather than a science. The optimum conditions for any given operation are best determined by trial and error. Suppliers of buffs, buffing compounds and buffing machines can often provide expert assistance in selecting the correct materials and procedures for specific jobs.

A residue of compound usually remains on the part after buffing. This must be removed, particularly if the part is to be anodized or plated. Removal may be accomplished by the use of emulsion or solvent emulsion cleaners, vapor degreasing, ultrasonic cleaning, bright dipping or electro brightening. A light caustic etch is also a good way to remove abrasive which would cause discoloration.

Scratchbrush; Satin Finish

Many aluminum products, especially utensils, are given a pleasing finish by pressing a rotating wire brush against the surface. This is scratchbrushing.

Size of wires in the brush generally determines the texture achieved: the thicker the wire, the coarser the finish. Use of a lubricant produces a more polished effect. If the part is to be anodized, use of a lubricant will help prevent the surface from taking on a dull gray color.

Excess grease and dirt must be removed from aluminum prior to scratch

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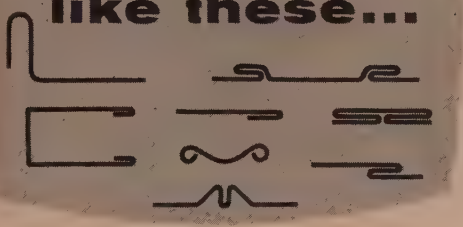

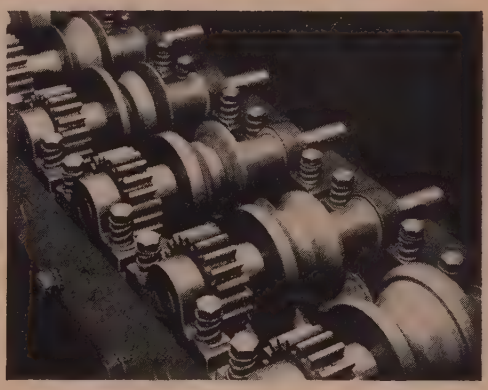

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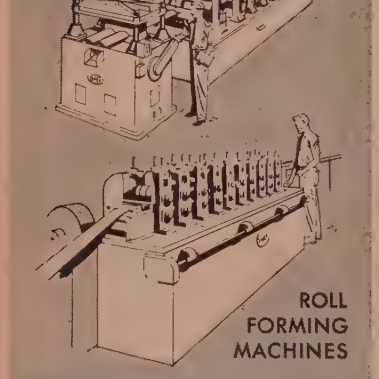

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brushing. The round wire brush may be up to 10 inches in diameter and made up of .015-inch diameter wires. Thinner wire (.005-inch diameter) will yield a satin finish.

For aluminum sheet and other wrought forms, a rotational speed of around 2000 rpm will produce good results. If the part is a casting, a considerably lower speed (450-600 rpm) should be used to avoid tearing of the surface. In either case, pressure of brush against part should be light.

As work progresses, the wires in the brush will become bent and worn in one direction. Periodic reversing of the rotational direction will help you get more mileage out of the brush. Rubbing the brush against a pumice stone or soft brick will rid it of particles of aluminum and oxide.

Satin Finishing — Somewhere between scratchbrushing and polishing is the group of mechanical finishing operations called satin finishing. Textures of varying fineness are obtained by using fine wire brushes or buffing wheels faced with abrasive. If the part is an extrusion, the satin finish may be attained with an abrasive belt machine. Whatever the process, the result is a soft sheen that is less brilliant than a polished surface and less coarse than a scratchbrushed surface. It may then be anodized or lacquered.

If a brush is used, wire diameter usually ranges from .002 to .005-inch. Speed of rotation is around 2000 rpm (for wrought products). If a buffing wheel is used, a loose muslin buff dressed with a greaseless compound containing No. 200 abrasive can be used at around 2000 rpm.

A circular object such as a saucepan can be given a satin finish by placing it in a lathe chuck and holding an oily abrasive cloth against the revolving aluminum surface. Steel wool plus oil and emery gives a brighter finish.

Be Careful With Castings

Castings require special attention if a satisfactory satin finish is to be obtained. It is important to provide a uniform base before the brush is used. For large flat surfaces a fine sand blasting may do the job.

In other cases it may be necessary to prepare the surface with sewed muslin wheels faced with No. 120 emery plus tallow, then 180 emery plus a greaseless compound. The surface should be cleaned before applying the satin finish with a brush. The brush should be run at a speed of 450-600 rpm.

When satin finishing with an abrasive belt machine, use a belt speed of 2400-3000 fpm and emery belts of No. 80 through 240 grit, depending on texture desired.

As for Equipment . . .

Machines for polishing, buffing an some satin finishing operations rang all the way from relatively simpl double-ended buffing lathes for manua work to rotary, indexing, or straigh line automatic polishing and buffin installations.

On lathes of the belt-driven variety pulleys of various sizes can be used t get different rotational speeds — an im portant advantage when performin different operations on different form of aluminum. When moderate produc tion runs are involved, some lathes ca be fitted with special fixtures that carr the parts to the wheel, thus eliminatin the uncertainty of hand-holding parts

Some buffing lathes also provid quick changeover fom one speed t another by means of variable spee drives between the motor and the ar bor. Regardless of your operation, yo are probably better off with machine having provisions for various speeds.

Abrasive belt grinding is done eithe on machines built specifically for thi purpose or on buffing lathes that hav been fitted with backstand idler pulleys In the latter case, the contact roll i mounted on the machine arbor and th backstand is arranged so that tensio and tracking of the belt can be con trolled. Here again, variable speed con trol is important.

Automatic machines combining seemingly endless variety of grinding polishing, buffing, and belt finishin operations are usually designed an built for specific operations. Usuall they are built up from standard o modular polishing and buffing head and abrasive belt units, and incorporat such additional powered units as con tinuous rotary tables, indexing table dust collectors, and the like,

Mechanical or vacuum chucks mount ed on the tables are used to carry part through an entire sequence of opera tions that will convert a raw part int a finished product in a few minute or less. Rotary indexing machines ar particularly popular for this purpose

For long parts such as extrusions an roll-formed shapes, conveyorize straight-line machines are built in al most any length and combination o mechanical finishing operations. As i indexing and rotary table machines automatic feeding of abrasives and buff ing compounds is usually provided.

Round tubing and bar stock are fin ished on centerless grinding and polish ing setups in which drive rolls carry the workpiece under or past powe heads fitted to perform successive opera tions from grinding and polishing through coloring.

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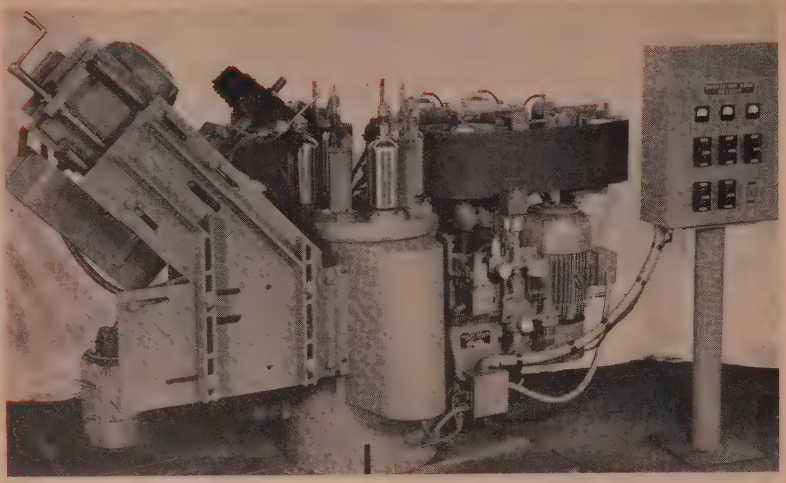

CASE HISTORY: Automatic Grinding and Polishing

■ *An automatic setup for grinding and polishing a formed aluminum part. Based on the Junior Automatic series of Murray Way Corp., Birmingham, Mich., it is built around a standard indexing dial table with four work spindles. Grinding is done by standard abrasive attachment that takes 90-inch belts. Polishing is performed by sisal wheels mounted on standard polishing head. Production ranges from 300 pieces per hour with 8.3-second dwell time and 2.8-second index time, to 1400 pieces per hour with 1.8-second dwell and .6-second index. Automatic units are usually built to specifications.*

of aluminum parts, you will probably be better off with some sort of automatic installation. Unit cost will be lower in the long run, and the machine will do a better, more uniform job than you can get with a large group of workers operating manual machines.

Maybe You Can Blast It

One of the quickest ways to finish an aluminum object is to place it in the cabinet of an abrasive blasting machine, turn on the pressure, and spray the part with a stream of abrasive. The result is a uniform matte surface, the texture of which depends upon the size and concentration of the abrasive particles used, the force with which they strike the part, and other factors.

Abrasive blasting is an old, familiar process, but technological progress has brought recent refinements that have greatly extended the method's area of application. Today, abrasive blasting is being used for everything from deburring and scale removal to the creation of high quality final finishes. In the aluminum industry it is generally used to prepare the surface for subsequent finishing such as anodizing, plating, and painting.

The wide selection of abrasive media used in this process ranges from washed silica sand to steel shot. Metallic abrasives are not recommended for aluminum; they leave a residue on the surface that can cause discoloration, particularly if the part is to be anodized. If they *are* used, however, metallic residues may be removed by etching or brightening. Silica sand is generally used in conventional dry blasting.

The blasting machine normally consists of a rectangular sheet metal box fitted with a view window, arm holes with heavy-duty rubber gloves, interior lighting, and doors for loading and unloading of the work.

Most machines have automatic suction abrasive feed which serves a blast gun incorporating an air jet and an abrasive nozzle. A flexible hose runs from the feed box to the gun and an air hose connects the gun with the compressed air supply.

When the operator has positioned the workpiece, he steps on a foot pedal that releases compressed air to the air jet. The partial vacuum that is created picks up abrasive from the feed cup and carries it into the nozzle. From there, the abrasive is propelled against the work by the air steam. The resulting abrading action cleans the surface, removes superficial blemishes, and imparts a non-directional soft matte finish.

Coarse crushed silica rock (6 to 20 mesh) will produce a rather rough blasted finish on aluminum when used with a ⅜ x 3-inch nozzle and an air pressure of 30 to 90 psi. If the workpiece is of fairly light cross-section, lower air pressures should be used to avoid warpage. The nozzle is held 12 to 20 inches from the work and the spray is trained at the surface at a 60 to 90 degree angle. For best results, the gun is moved in parallel lines along the full length of the work.

Finer grades of sand are generally used on aluminum, however. A smoother surface will result from the use of 40 to 80 mesh silica blown at a pressure of 30 to 90 psi. The nozzle may be ⅜ x 3-inch or ½ x 3-inch, and should be held 8 to 14 inches from the work.

For a still finer finish, use 100 to 200 mesh silica at 30 to 75 psi with a ¼ x 5-inch or ⅜ x 3-inch nozzle. If the part is to be anodized after blasting, it is best to give it a caustic etch first. This will avoid a dark gray mottled appearance that might result from blasted-in contaminants.

Wet blasting is a relatively recent development that has greatly extended the utility of this cleaning and finishing method. Wet blasting permits the use of much finer abrasives (which means a finer finish and closer control of metal removal) since the abrasive is mixed with water and other chemicals.

The liquid acts as a carrier so that the extremely fine abrasive will not clog the nozzle and will strike the workpiece with sufficient force to dislodge contaminants and impart the characteristic "etched" appearance.

Wet blasting installations of considerable size are being used to process everything from appliance trim to entire aircraft wing panels. Such installations are usually automatic and conveyorized for rapid production.

Manufacturers of the equipment report that the process imparts a chemically clean surface on aluminum, preparing it for subsequent operations such as conversion coating, anodizing, plating or painting. The wet blasted surface may have a roughness ranging from 5 to 200 microinch R.M.S.

Finish 'em in a Barrel

When a large or moderately large number of relatively small aluminum parts are to be given a fairly bright finish, barrel tumbling may well be the most economical method. Like abrasive blasting, this is an old, familiar process that has lately undergone considerable technological improvement to extend its range of usefulness. Today it performs metalworking operations that were once considered the exclusive domain of other, more costly processes.

Replies to Modern Metals' finishing survey (see page 35) reveal that barrel finishing is a moderately popular process in the aluminum industry. Of the 3[illegible] plants that do at least some of their own aluminum finishing, 91 reported barrel finishing operations. In virtually all cases, other types of cleaning or mechanical operations were also reported.

The operations most commonly performed in barrel tumbling include d[illegible]

WEATHER-RESISTANT BUTYRATE LACQUERS PRESERVE THE NATURAL BEAUTY OF ALUMINUM

Here's welcome news for aluminum fabricators.

Clear, colorless Butyrate lacquer—a new type of coating—provides lasting weather protection for aluminum.

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Butyrate lacquers are easy and economical to use...afford excellent protection with a single coat. They are available from lacquer manufacturers in all parts of the country.

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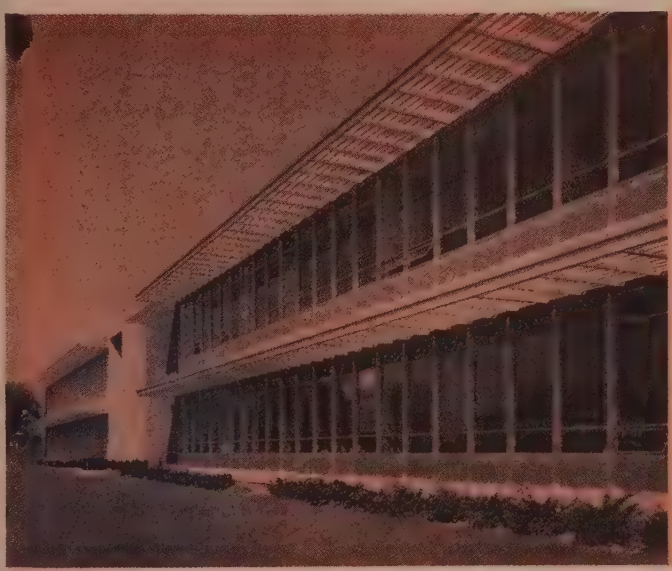

North Central High School, Indianapolis, controls sunlight and reduces summertime heat transmission with aluminum sun cornices made by O. O. McKinley Co., Inc., of Indianapolis, Indiana. The satin finish of the aluminum surface is protected from weathering by a clear, colorless Butyrate lacquer.

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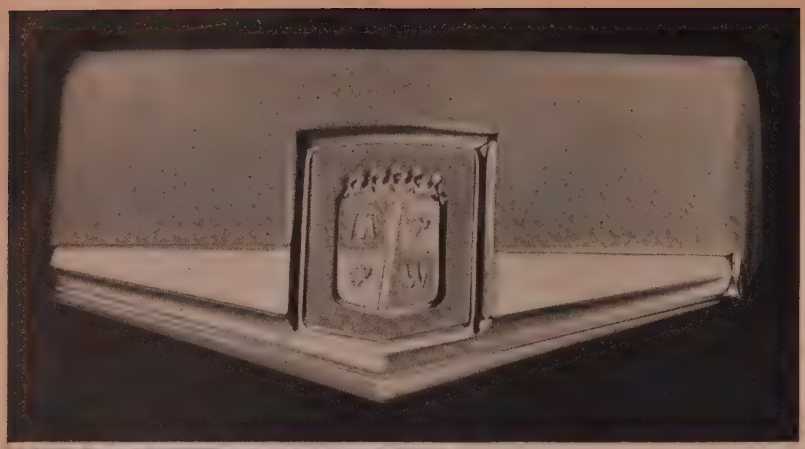
(2) Check Sweet's Industrial Construction File, Sweet's Architectural File, and 15-M of the A.I.A. Alphabetical Filing System for specification details.

(3) Send for sound color film. Please indicate the date you plan to show the film and an alternate date.

(4) Write for names of manufacturers of Butyrate lacquer.



CASE HISTORY: Wet Blasting Trim for Two-Tone Finish

Aluminum appliance trim by Name Plate & Monogram Co., Wapakoneta, Ohio, receives attractive 2-tone anodized and painted finish after surface is prepared in automatic wet blasting machine built by Wheelabrator Corp. Parts are buffed, blasted, anodized and painted. Wet blasting with very fine abrasive gives surface uniform matte finish for anodizing. Plant photo shows blasted parts being removed from conveyor. Small conveyor carries fixtures back to entry end of blasting machine.

burring, burnishing, and grinding or polishing. Other operations include cleaning or degreasing, descaling, forming of radii, improving color, blending of parting lines, etc., reduction of surface porosity, rust inhibiting, etc.

Obviously, some of these have little or no application in the aluminum industry. Deburring, burnishing, cleaning, and some form of abrasive polishing are the barrel operations most commonly performed on aluminum.

Barrel finishing is performed in a rotating barrel-shaped container, usually of welded steel construction with a rubber or hardwood lining. The parts to be finished are placed in the barrel along with water, an abrasive or burnishing medium, and perhaps a finishing compound. The barrel is then rotated for a predetermined period at a predetermined number of rpm's.

When the cycle is completed, the barrel is drained and emptied. The parts may then be cleaned and dried by some other method, or subjected to another barrel tumbling operation that will further refine the finish or clean or dry the parts.

The action in the barrel may be of four types — chipping, abrading, flowing, or chemical. The first three take place as the result of a sliding action induced by the rotation of the barrel. The work load continually moves upward to a turnover point where gravity overcomes the cohesiveness of the mass and causes the top layer to slide toward the bottom of the barrel.

Since 90% of the abrading or burnishing action occurs during the slide, optimum conditions will produce the longest slide possible. Generally, the length of slide is determined by speed of rotation of the barrel and the height of the work load. If the barrel rotates too fast, the parts will fall rather than slide, and may be damaged. At too slow a speed the sliding zone is sluggish and too restricted. Most commercial machines have variable speed drives providing rotational rates of 6 to 30 rpm.

Uniform, Predictable Results

Other variable in the process include size and type of barrel, size and shape of part, number of parts per load, type and amount of tumbling medium, type and amount of compound, ratio of medium to parts, and time cycle. With this many variables, it is obvious that no rigid operating procedure can be established. Optimum conditions must be determined for each job.

Once these conditions have been established, however, a predictable, uniform finish will be produced time after time. This predictability is one of barrel finishing's strong points; uniformity from piece to piece and from batch to batch is achieved without skilled labor.

Burnishing is probably the most common barrel finishing operation performed on aluminum. The medium in this case consists of hardened, high polished steel balls. A neutral soap co pound is generally added to the wo load. Main purpose of the compoun is to provide lubrication.

The ratio of steel shot to aluminu parts may range from 4 to 1 to 8 to – depending, usually, on the size of th part. Parts are usually cleaned or etche and rinsed before being placed in th burnishing barrel. The work load shoul be equal to about 50% or 60% of th volume of the barrel. Enough water added to cover the load, and the bu nishing compound is added. Th amount may vary from 1 to 4 ounc per gallon of water; makers of propri tary compounds give complete instru tions for their use.

The barrel is rotated for one-half t one hour, as required, then drained Parts are separated from steel balls, the washed and dried. The steel balls ma be returned to the barrel and treate with a rust inhibiting compound. Som times, two successive burnishing step are employed to achieve an exceptio ally bright finish on aluminum.

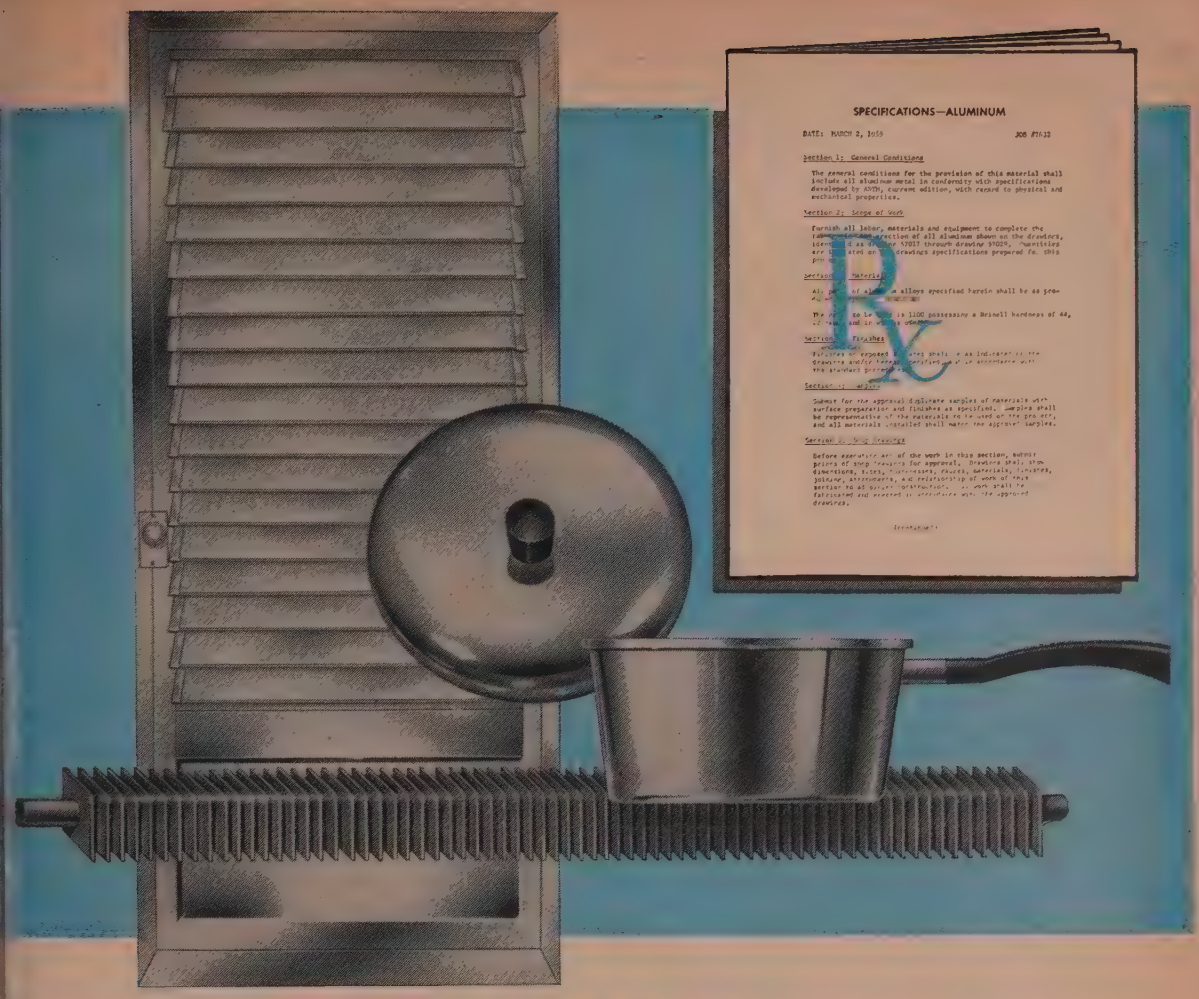
The routine is roughly the same fo other operations such as barrel grindin or polishing, except that an abrasiv medium is used (usually oxide chips o various types), along with a special com pound that prevents glazing of chips.

It's important to make sure that n strong alkali is used with aluminum; th resultant generation of hydrogen coul touch off an explosion. Use only com pounds that are recommended for alu minum. Suppliers of compounds ar explicit on this point.

Barrel finishing is usually confined t small parts; it is generally agreed tha the maximum dimension of the tumble workpiece should not exceed one-thir the diameter of the barrel. However large parts and some highly intricat shapes are now being barrel finished b fixturing them in the barrel. A properl designed fixture anchors the workpiec securely — usually to the doors of th barrel — so that only the tumbling me dium moves when the barrel rotates.

In one case, cast aluminum drill gu housing parts are processed 100 at time. The housing is made up of thre separate parts, the color of which mus be identical. Uniform coloring is at tained by tumbling the fixtured parts i the same barrel.

Developments such as fixturing o parts, multi-compartment barrels, autc mated systems, and improved compound and media have greatly expanded th role of barrel finishing in the meta working industry. Many firms that pro ess aluminum parts have found tha barrel finishing is a necessary adjunct c other finishing operations.



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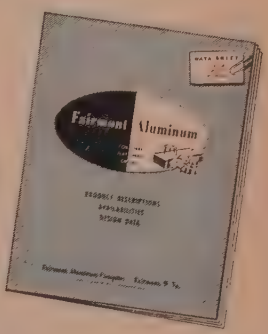

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CHEMICAL FINISHING OF ALUMINUM

caustic etching — desmutting — chromate conversion coating phosphate conversion coating — phosphate-chromate conversion coating — modified Bauer-Vogel process — bright dipping — British and German brightening methods — chemical polishing

CHEMICAL finishing may be defined as any process in which reagents are used to dissolve or chemically react with the metal surface to alter its form or to produce a tightly adherent chemical compound. These finishes are often among the cheapest finishing procedures from the standpoint of equipment used and processing time.

Of the 406 plants responding to the Modern Metals survey, 327 reported performing at least one cleaning or finishing operation on aluminum. The number of plants engaging in chemical finishing was 183, or 55% of the total.

A wide range of chemical treating processes has been developed over the past ten or 12 years. The more important ones are described in the following pages.

When to Etch

When a chemical reagent is used in solution to attack and roughen the surface of metal it is called etching. Because this treatment lowers the corrosion resistance of aluminum by removing the natural oxide film, some subsequent finishing process must be performed to restore corrosion protection.

The etching process sometimes is used to produce a diffused reflective surface on aluminum parts that are destined for decorative uses. Architectural assemblies — anodized curtain wall panels, for instance — are etched before anodizing because of the uniform luster created. When color anodizing is to be performed, the etch will also promote color consistency.

Etching is the most common chemical treatment used on aluminum, as revealed by Modern Metals' finishing survey. Of the 183 plants that perform some type of chemical finishing of aluminum, 144 plants (78%) reported etching operations.

Etchants used on aluminum are divided into two broad groups — alkaline and acid. Alkaline etchants are by far the more popular type, mainly because they are cheaper, require less expensive equipment, are easier to handle, and usually produce a brighter etch. Acid solutions are generally used in special cases, such as design etching.

Caustic Gives Frosted Finish

Caustic etch is the standard term for the process which produces a silvery-white or frosted finish on aluminum sheet, extrusions, castings, etc. Caustic etch is the most widely used chemical finish on aluminum and can be produced in various surface textures including a matte finish, a soft lustrous surface, or a dull frosted finish. Usually no precleaning is required, but if heavy grease is present the safe practice is to solvent degrease. Some alloys require an acid etch before the caustic etch.

Caustic etching eliminates surface scratches, pick marks, nicks, and other surface imperfections. Aside from the pleasing appearance the treatment gives to the aluminum, it removes the glaze that comes off an untreated surface.

Caustic etch baths vary in concentration and operating temperature. A typical bath is made up of 2 to 8 ounces of caustic soda, soda ash or trisodium phosphate per gallon of water. Bath temperature is 140° to 180° F.

Usually, one of the many good proprietary etchants is used instead of the straight caustic bath. Reason: The uninhibited caustic bath precipitates a hard, compact sludge or scale on heating coils, tank bottom, etc.

Proprietary etchants contain additives to prevent formation of this hard-to-remove scale. Starch is one such additive. Others include lignin sulfonate, sorbitol and salts of hydroxy acids.

Some additives tend to keep the etchant sludge in an amorphous condition; others hold sodium aluminate in solution (in which case, the caustic content of the bath must be held at a high level). Still other additives cause a light fluffy sludge to precipitate continually. This must be removed periodically, but it is simply flushed out instead of laboriously chipped off as is the case with normal crystalline sludge.

Caustic etch dip tanks should be fabricated from mild steel. Solution temperature is kept around 140° — sometimes higher, and the immersion time ranges from five to ten minutes. After etching, the work should be rinsed in cold running water.

The dark smut produced on the al

CASE HISTORY: Etching Aluminum Windows

Several years of intensive research have culminated in development of an etching compound in solid form. Pennsalt Chemicals Corp., Philadelphia, inventor and manufacturer of the new product, said that in addition to greater handling convenience, AE-16S solid etchant is dustless and gives off no heat of solution. It is now in use at Philadelphia aluminum window plant of Fenestra Co. A worker is shown slitting the solid compound's metal container. Packed in a 90-pound size now, AE-16S might be made up in 300-pound drums for users of large etching tanks.

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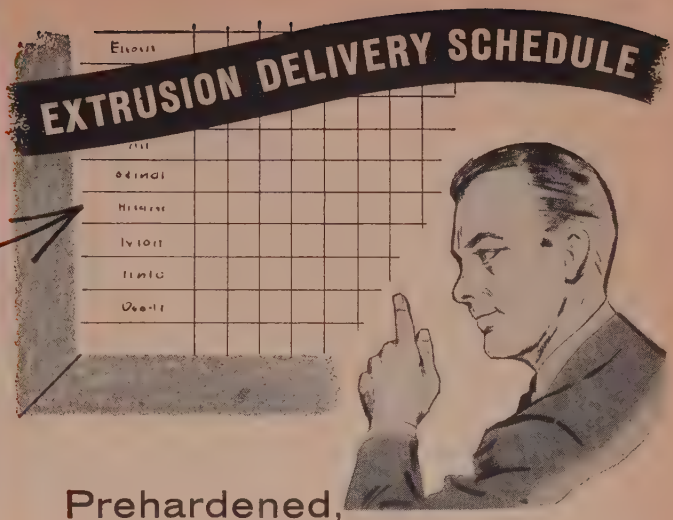

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CASE HISTORY: Conversion Coating Aluminum Strip

■ ***Consistent quality of conversion coating is essential in high volume aluminum processing. Hastings Aluminum Products, Inc., Hastings, Mich., one of the largest roll coaters of aluminum sheet and strip, has used the same processing bath for the past two and a half years without the necessity of nozzle cleanout or other tank maintenance. Aluminum sludge and other impurities are removed as formed by ion-exchange resins in the bath.***

During this period more than 100,000,000 square feet of aluminum have been coated, with no deviation in finish quality. The processing solution used is Bonderite 721 (chromate oxide type), product of the Parker Rust Proof Co. Above, Hastings' coating line starts in right foreground (uncoiling, pretreatment, Bonderizing); makes 180° turn at far end to go through roll coater and bake oven to slitters and recoiling (left).

minum surface by caustic etching is removed by immersing the work in a proprietary desmutting bath or in a cold nitric acid solution varying in concentration from 20 to 50%. The work is rinsed in water again and then dried.

Caustic etching removes the natural oxide film from the aluminum surface. To prevent fingerprints and other staining, the surface may be protected by the application of anodic coatings, lacquers, enamels, or other finishing systems.

Another improvement in etching compounds has been the development of an etchant in solid form.*

Dusty caustic materials, dangerous heat of solution resulting when highly concentrated alkalies are added to solution, and the high cost of etching compounds are some of the conditions said to be remedied by this new product.

Packaged in 90-lb. containers for convenient handling, this new proprietary product is well suited for the most widely used etching bath tanks and offers all the advantages of its original powder formulation. It is non-scaling, minimizes or eliminates sludge, and is said to produce a satiny etch. The manufacturer is surveying the metal finishing field to determine the need for a 300-lb. cake of solid etchant.

*Pennsalt Chemicals Corp., Philadelphia 2, Pa.

Desmutting: Why and How

After etching or etch cleaning it is generally the practice to subject the work to a further treatment to remove smut — certain metallic impurities that gather on the surface.

Theory is that aluminum is so reactive compared with most of its alloying elements, that the etching solution dissolves the aluminum at a faster rate, leaving the insoluble elements captured in a viscous film on the surface of the metal.

Although nitric acid is one of the oldest known agents for desmutting (it can be used in a 20-50% solution at room temperature), proprietary desmutting compounds are safer to handle, with less trouble involved. Sulphuric acid solutions, an optional desmutting agent, are used at around 180° F.

Where the high silicon alloys are to be treated—as in castings, for example —a 3-to-1 mixture of nitric and hydrofluoric acid is used. Here, too, you are better off with a proprietary desmutter.

Die castings require nitric-hydrofluori immersion of only 15 to 30 seconds sand castings, 1 to 2 minutes. Naturally the tank used here must have a lining of some material that resists the acid solution.

Design Etching

In design etching, where areas no to be etched are masked, a hot acid ferric chloride solution is used as the bath. The etch is uniform and achieved quickly.

In another design etching technique the design is printed on aluminum after which the design is dusted with asphaltum powder which clings to the ink-dampened design. The excess powder is removed, and the powder remaining on the design is baked on at 400° F.

Next, the metal is immersed in a 10% hydrofluoric acid solution and rinsed after which it is etched in a solution of iron chloride and hydrochloric acid which attacks the unprotected, or unprinted areas of the aluminum to produce the final design. Acid is removed with a final rinse.

Another use for etching is to increase the surface area of aluminum foil used in capacitors. Since most electrolytic capacitor anodes are now made of very high purity aluminum, the use of hot dilute hydrochloric acid solutions has gone by the board because of the slow reaction of hydrochloric acid on high purity aluminum. Most electrochemical etching is now done in sodium chloride baths.

Conversion Coatings: Chromate

The use of conversion coatings on aluminum has grown rapidly in the past 12 years. The reasons for this popularity include the ability of these coatings to ward off corrosion — primarily that type induced by moisture; their efficacy as a base for paint; and the attractive iridescent colors that can be produced should they be used decoratively.

Of the 183 plants reporting to Modern Metals that they performed chemical finishing operations, 63 said that they do conversion coating. Doubtless the number is considerably greater since many plants, in filling in their questionnaires, ignored the "Conversion Coating" space for checking, but wrote in elsewhere on the form such proprietary terms as Iridite, Bonderite, Chromate coating, and Alodine. Presumably the term conversion coating isn't known to all users of these products.

All chromate conversion coatings use chromic acid or one of its soluble salts which contain hexavalent chromium. Applying the chromate solution to clean aluminum produces a thin, gel-like film which is an integral part of the meta

(*Continued on page 71*)

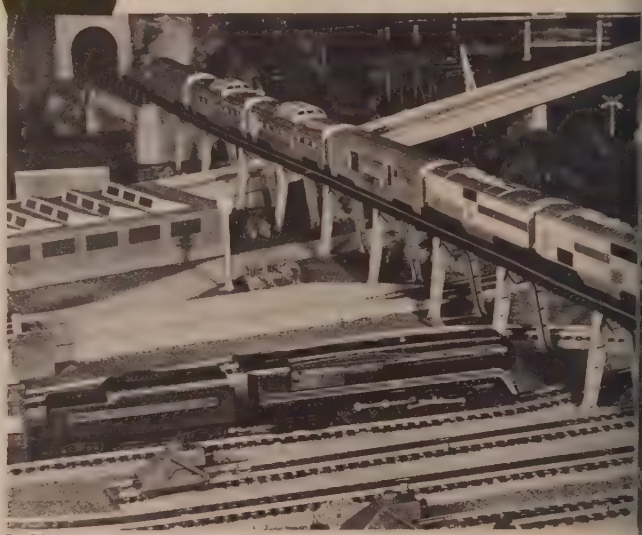
"the fast way out of today's profit squeeze is through the use of more efficient materials which cost less to machine and fabricate, yet produce a better product..."
i.e. Die-Casting with Asarco Zinc Alloys

ASARCO

SEE NEXT PAGE

Die-Casting with Asarco's Federat

Low machining costs, superior castability, and an excellent plating surface are the big reasons why Di-Metal castings are favored for fuel pumps, carburetors, grilles, lamp housings, instrument panels, horn rings, and many other functional and decorative automotive components.



Di-Metal castings make possible the faithful reproduction of detail that's so important in producing trains and other toy miniatures which look "just like the real thing."

The low cost, fine detail, complex shapes, and brilliant finish possible with zinc die-casting has become increasingly appealing to manufacturers of costume jewelry.

Di-Metal Zinc Alloys *can cut your costs...and produce a better product in the bargain!*

Every designer will sit up and take notice when he sees how easy it is to produce miniature objects with movable parts, even linkage, in one Di-Metal zinc casting. This is actual size of die-cast scissors.

Zinc die-casting provides the hardware field with the smooth cast surfaces so necessary in producing an attractive, lasting finish.

When gears, cams, hubs, and shafts can be integrally cast in one piece by zinc die-casting, a costly assembly operation is eliminated.

There's a big swing in metal parts production today to die casting with zinc—and it certainly makes good sense.

For one thing—Federated Di-Metal (alloyed from Asarco's Special High Grade Zinc 99.99 plus % pure) is lower in material cost.

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Die casting with Federated Di-Metal can produce the most complex shapes, the thinnest section walls, the smoothest casting surfaces. The castings have impact strength and other mechanical properties superior to other casting metals (with the possible exception of copper which, of course, costs more). And zinc die-castings can be readily electroplated or coated.

When you're both cost and quality conscious, you can't afford to by-pass die casting with Federated Di-Metal. It is proving the fastest way out of the present "profit squeeze" for a growing list of manufacturers in many fields.

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1. Integrated Production. Federated Di-Metal is alloyed using electrolytically refined Special High Grade Zinc from ores mined by Asarco. Alloys are produced "under one roof" at Corpus Christi, Texas, one of the world's largest electro zinc producing plants — assurance of highest purity and uniformity at lowest cost.
2. Nation-wide Service and Distribution. Always a Federated field engineer near you, on call from 23 sales offices throughout the country. Federated Di-Metal is stocked for immediate shipment from a nation-wide system of distribution centers.
3. Asarco booklets and bulletins of great working assistance to the die casting industry, detailing efficient working practices, selection of alloys, vital technical data. Write for your free copy of "For Better Die Castings," to your nearest Federated Sales Office or to ASARCO Federated Metals Division, 120 Broadway, New York 5, New York.

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ASARCO

but converted to a nonmetallic

romate treatments produce effective bonds through molecular adhe- the film being bound to the metal ce by this means, and in turn offer- he same type of adhesion to the ic coating. The film also lengthens life of the paint job, forming an ive barrier against corrosive attack igh pores or scratches in the paint. e coating is applied by dipping, ing, roller coating, brushing or bing. Formulation of this solution the degree of its application (im- ion time or spray intensity) dictate lensity of the color of the film. The s capable of being produced on inum are yellow and brown in vari- shades. A clear coating can also be uced by bleaching.

e great range of aluminum alloys es a corresponding variation in the arance of chromate coatings using ven set of treatment conditions. alloys so treated would produce s ranging from pale yellow to deep n.

high silicon aluminum casting and w silicon wrought product would widely different hues. Color of ings on as-cast surfaces is usually h lighter than those on wrought s.

hough the thickness of the film is nated variously at 0.00001 to 0.00003 , it is amorphous (which permits forming without rupture of the and non-porous (which explains its tiveness against corrosion).

spite of the fact that the chromate hasn't the hardness of an anodized h, it will stand up fairly well against sion of a non-cutting nature.

n important quality claimed for mate coatings is their ability to heal ches in the film. If a scratch pene- es the film, the exposed metal grad- y becomes covered by soluble chro- from areas surrounding the scratch.

hromate films have low electrical tance, though this property varies ween types of coatings. The films re- electrolytic action between dissimi- metals; for maximum protection, parts should be chromated.

ompared with anodizing installa- s, equipment needed for chromating ninum is extremely simple. A stand- chromating line includes a cleaning , two or three rinsing tanks, and a ial tank employing some acid resist- material to hold the chromate solu- .

his tank can be made of steel with ner of some acid resistant plastic, or structed solely of stainless steel if solution doesn't contain hydrochloric or chlorides. Stoneware is another resistant material which can be used to hold the chromate solution.

If bleaching or dyeing is to be a part of the finishing operation, an extra tank or two will be needed. Dip baskets or racks are used for holding the work. Forced or circulated air drying equipment is generally used.

Most chromate baths are used at or near room temperature. Control of temperature is desirable though not critical. Since fumes are practically non-existent, venting the line isn't necessary. Time requirements for each of the steps in the chromating process are short.

The various steps in the chromating process follow, with related facts and recommendations.

It's Gotta Be Clean

Proper cleaning of the bare aluminum is essential in the chromating process. Oil, grease and other forms of soil must be removed completely. Vapor degreasing, solvent wiping and emulsion cleaning are effective pretreatment methods. Proprietary inhibited alkaline cleaning compounds can be used for soak cleaning. Such factors as degree and type of surface contamination, alloy involved, and the user's equipment will dictate the pretreating compound to be used. Dimensional tolerances of the product must also be considered.

Where oxides are present, an acid dip is used to promote uniformity of the chromate coating. There are several chromate deoxidizers on the market, all of which are effective in dissolving oxides without attacking the metal.

If an etched surface is not objectionable, both surface contaminants and oxides can be removed in a single step using a hot alkaline etching solution. While this is considered the most effective pretreatment process, it usually leaves a smut of alloying metals on certain alloys. If silicon, a 3 to 1 mixture of nitric-hydrofluoric acid will dissolve it. Otherwise, it can be removed by nitric acid (40° Baumé, diluted 50-50 with water), or by a chromate deoxidizer.

In the case of newly plated aluminum, the work can be chromated directly, after rinsing, without further treatment; but where excessive alkaline plating solution remains, a dilute acid dip is often used as a neutralizer.

Rinse It Thoroughly

Wherever it occurs in the process, rinsing is very important. Hot or cold water is used; when hot water is used, it is generally between 140 and 160° F., though some operators find lower temperatures more desirable for certain jobs. An incomplete rinsing step can impair final coating results.

Chromating is done by immersion, spraying, roller coating, brushing or swabbing. There are several proprietary formulations in powder or concentrated liquid form. These formulations offer

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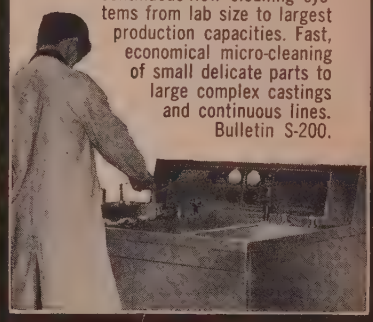

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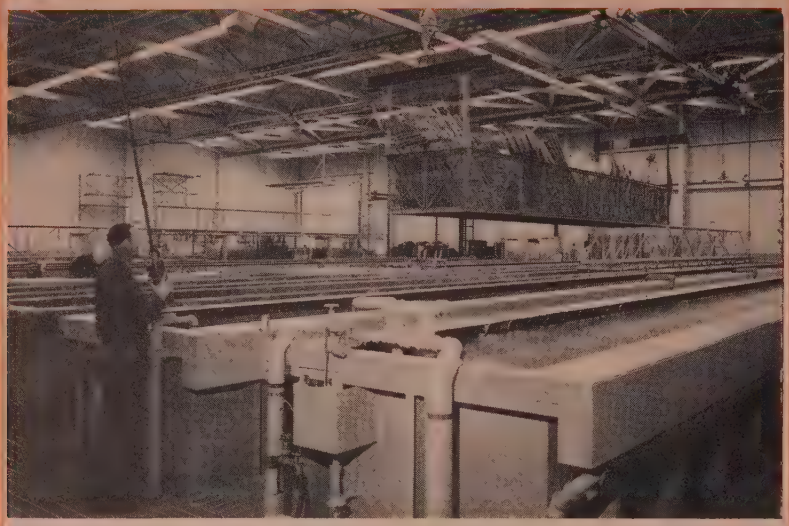

CASE HISTORY: Conversion Coating Extra Large Parts

Giant aircraft wing and spar assemblies of aluminum can be prepaint finished with the same effectiveness as small parts. Shown here is a large Alodizing installation wherein a series of 80-foot-long dipping tanks are used to coat 76-foot airplane spars and whole wing panels with Alodine, product of Amchem Products, Inc., Ambler, Pa. Use of Alodine has, in one instance, enabled a prominent airframe manufacturer to eliminate one prime coat of paint and effect a considerable saving in weight of overall aircraft. Amchem has five compounds for aircraft.

the user a wide choice to satisfy the requirements of alloy, method of treatment, and whether the film to be produced is for paint base or finish coat. Temperatures range from 60° to 150° F., treatment times vary from five seconds to eight minutes, with spraying requiring only seconds compared to minutes required for immersion. Where spraying is done, the solution is somewhat cooler.

For Uniform Color . . .

In order to achieve uniform coating quality and color over long production runs, the operator must take steps to maintain the chemical quality of the bath, which becomes depleted with day-to-day use. At the same time, contaminants accumulate which lower coating quality.

Analysis for each separate ingredient in the chromate solution isn't necessary. Use of a meter to measure the pH factor, and a simple titration to determine the hexavalent chromium content will establish the addition that must be made.

Determining the solution's total acidity by titration can be unreliable because metal accumulation in the solution causes buffering. Control by tests of specific gravity are also unreliable for the same reason. Some operators are able to maintain consistency of the bath by pH control alone, while control by appearance of the work is possible, using samples of finished work as color standards.

With certain formulations, the bath must finally be dumped and a new solution prepared. The batch is known to be unusable when normal coatings are no longer obtained even though tests indicate proper chemical balance, or when the bath is kept effective only by excessive additions.

Evidently, the accumulation of contaminants is the main cause of the bath's final debility. These include the formation of trivalent chromium in the film-forming reaction, metal dissolved off the work into the solution, and other contaminants that are dragged into the bath.

Expected bath life varies with the treatment; depends on the thoroughness of cleaning and rinsing operations, as well as the extent of dragout.

A new development in chromate treatments has produced compounds which include ion-exchange resins. These resins remove aluminum and other impurities as they are formed. Thus, it is never necessary to dump the bath.

Following the chromating treatment, the work is rinsed. It's always good practice to use deionized rinse water.

Bleaching, Dyeing

These steps are optional. Bleaching is done to eliminate the yellow tint produced by the soluble hexavalent chromium compounds. These soluble c pounds can be leached out by appl dilute acid or alkali solutions to newly formed film. This leaves an soluble film which has less corro resistance than the unbleached film

Water alone would have the s bleaching action but would be consi ably slower. Prolonged acid or alka leaching will eventually remove only the soluble but the insoluble tion of the film as well.

Dyeing must be preceded by ble ing. Dyes designed for chromate coat are not light-fast.

Drying the Work

To speed drying, the last rinse car made fairly hot if the chromate tr ment used permits this. Air blast centrifuging, or the use of warm air optional drying methods. Air tha too hot can lower the corrosion re ance of the film.

The film is soft and absorptive w newly formed and takes some time set during and after the drying pro Care should be taken during this set period to protect the coating f abrasion.

Phosphate; Phosphate-Chroma

Phosphate conversion coatings are plied to aluminum by immersing, bu ing, or spraying the work with a m acid phosphate solution containing dizing agents and a complex fluo for accelerating the action. The version coating produced is a fi crystalline, nonmetallic phosphate ing which will inhibit corrosion serve as a paint base.

One of the usual pretreatm methods can be used. A typical sequ would be: Pretreat, water rinse, p phatize, water rinse and chromic ac phosphoric-chromic acid rinse, foll by drying.

In phosphatizing, the conversion ing is produced after 30 seconds minutes immersion at 170-185° F by spraying for 10 seconds to 2 mi at 140-155° F. The process time de upon the type of alloy and surfa quired.

In some cases, dictated by the ty aluminum stock being processed a as the type of coating desired, a pre ment of alkali or acid pickling i formed to promote formation of a grained coating.

Coatings produced by phos chromating are considerably t than those obtained by the prev mentioned processes and are use decorative purposes — screening dustrial and residential siding an ing. The color varies from very p sea green, depending on coating ness. Being an inorganic materi

A 63S Alloy aluminum extrusion, actual size, extruded on a 14-mandrel die. Samples of this extrusion on request

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Conversion Coatings for Aluminum

Company and Proprietary Name	Application Method	Recommended for Coating
Chromate		
Allied Research Products Inc. Baltimore 5, Md.		
Iridite No. 14 Al-Coat	Dip, brush, swab or spray	Sheet, plate, castings, extrusions, forgings
Iridite No. 14-2 Al-Coat	"	"
Iridite No. 14-9	"	"
Alcoat-Clear		
Amchem Products, Inc. Ambler, Pa.		
Alodine 600	Dip or spray	Sheet, plate, castings, extrusions, wire,
Alodine 1000	(liq'd) dip or spray	fabricated
Alodine 1200	Dip, spray, brush or swab	"
Alodine 1200S	"	Sheet, plate, castings, extrusions, fabricated
Alodine 1500	"	" and wire
The Chemical Corp. Springfield 9, Mass.		
Luster-on Aluminum Sealer	Dip, swab, brush or spray	Sheet, plate, castings, extrusions
Conversion Chemical Corp. Rockville, Conn.		
Kenvert	Dip	Sheet, plate, castings, extrusions
Frederick Gumm Chemical Co. Kearney, N.J.		
Alcorite	Spray, Dip	All shapes
Hanson-Van Winkle-Munning Co. Matawan, N. J.		
Chem-Rite A-22	Brush or swab Dip or spray	Sheet, plate, castings, extrusions
Heatbath Corp. Springfield 1, Mass.		
Alchrome No. 2	Dip, brush, swab or spray	Sheet, plate, castings, extrusions
MacDermid Inc. Waterbury, Conn.		
MacroAlum 3, 4 and 5	Dip or spray	Sheet, plate, castings, extrusions
Oakite Products Inc. 45B Rector St., NYC		
Chromicoat	Dip or spray	Sheet, plate, castings, extrusions, other
Parker Rust Proof Co. Detroit 11, Mich.		
Bonderite 721	Dip, spray, brush, roll coat, swab	Sheet, plate, castings, extrusions
Bonderite 722	Dip, spray, brush, roll coat	"
Bonderite 723	Dip, spray, brush	"
Promat Div. Waukegan, Ill. Proseal 16	Dip, spray, brush, roll coat, swab	Sheet, plate, castings, extrusions
Turco Products, Inc. Wilmington, Calif.		
Turcoat 4178-6	Dip, spray, brush, roll coat, swab	Sheet, plate, castings, extrusions, forgings
Turcoat 4354	"	"
Turcoat 4477	"	"
Phosphate		
Amchem Products Inc. Ambler, Pa.		
Alodine 401	Dip, spray, brush or swab	Sheet, plate, castings, extrusions, fabricated
Neilson Chemical Co. Ferndale, Mich.		
Alumiprep No. 1	Dip, spray	Sheet, plate, castings, extrusions
Alumiprep No. 20	Brush	
Parker Rust Proof Co. Detroit 11, Mich.		
Bonderite 701	Dip, spray, brush, roll coat, swab	Sheet, plate, castings, extrusions
Bonderite 170	Dip, spray, roll coat	"
Pennsalt Chemical Corp. Philadelphia 2, Pa.		
Albond	Spray, Dip	All types
Promat Div. Waukegan, Ill. Proclean Albond	Dip, spray	Sheet, plate, castings, extrusions
Turco Products Co. Turco WO-1 Wilmington, Calif. Turco WO-2	Dip, brush, roll coat, swab	Sheet, plate, castings, extrusions, forgings
Chrome-Phosphate		
Neilson Chemical Co. Ferndale, Mich.		
Lyfanite S-42	Spray	Sheet, plate,
Lyfanite D-61	Dip	castings, extrusions

color is stable in sunlight and res
weathering well.

Phosphate-chromate coatings do
have good abrasion resistance and
not washed readily by rainfall. For th
reasons a coating of clear methacryl
lacquer, having a minimum dry f
thickness of .0006 inch, is added
applications where cleaning is in
quent or where abrasion may be
problem.

Modified Bauer-Vogel Process

MBV is the abbreviated name of
process for producing a protective ox
film on pure aluminum and copper-f
aluminum alloys.

Treatment is by immersing the w
in an aqueous solution of 5% sodi
carbonate and 1.5% sodium chrom
for 3 to 5 minutes at 195 to 212°
then water rinsing. Color of the coati
ranges from light to dark gray.

In cases of MBV treatment of m
nesium bearing alloys, a progressiv
brighter oxide finish is obtained with
creasing magnesium content, with
reduction in corrosion protection. T
coating is considerably thicker than t
produced naturally.

The MBV-produced coating has o
fair abrasion resistance and is hig
vulnerable to acids and alkalies. Ad
tion of a lacquer coating not only gi
better paint adhesion but raises
rosion protection considerably.

While the work doesn't always requ
pretreatment, usual practice is to p
clean with organic solvents or inorga
cleaners.

In the case of castings containing m
nesium and silicon, a brief treatment
an alkaline pickling solution is de
able. Then the work is given a dip
dilute nitric acid for 15 to 25 minu
at 95 to 100° C., followed by thorou
cold, then hot, water rinsings.

The work is then oven-dried at
to 150° C. If lacquering is to be do
it must be applied as quickly as possi
after this.

The MBV treatment of copper-bear
aluminum alloys calls for the additi
of sodium silicate to the MBV soluti
and is referred to as the EW proc
The coating produced is smoother a
less receptive to lacquer.

Bright Dipping

Chemical brightening solutions of
a simple and effective method of
parting a bright finish to aluminu
While the bright dipping step is gen
ally associated with a subsequent a
dizing treatment, the development
non-yellowing clear organic coati
suggests increasing use of this simp
treatment in the future.

(*Continued on page 76*)

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"Miss Byrd, I've got a rush order for aluminum. Get me QSM on the phone."

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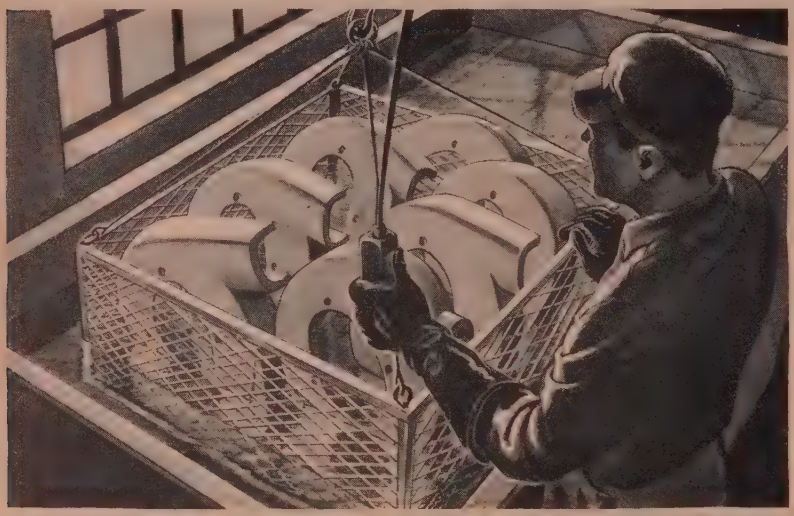

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This is a conversion coating you can depend on. Oakite ChromiCoat protects for hundreds of hours under the ordeal of salt-spray tests . . . and surpasses MIL-C-5541 specs *several times over!*

And the Oakite process is simplicity itself. No control problem. A thin, golden, uniform coating every time.

ChromiCoat is just one of a line of more than 30 Oakite materials designed especially for aluminum. There are etch and non-etch cleaners . . . barrel finishing compounds . . . safe paint strippers . . . forming lubricants.

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OAKITE

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years' leadership in industrial cleaning

The Modern Metals' survey on cle
ing and finishing operations in the li
metals' industry revealed that, of
183 plants that said they chemic
finish aluminum, 97 do bright dipp

Bright dipping employs a mixture
acids, usually phosphoric acid and ni
acid, plus certain additives such
copper salts and wetting agents. So
formulations use fluorides with ni
acid and other additives.

Solutions are generally used at 200
with an immersion time of 3 to 5 m
utes in stainless steel dip tanks. Fu
from this bath must be vented as t
are toxic.

The chemical industry has develo
many effective proprietary formulati
for brightening aluminum and doubt
new ones will be introduced from ti
to time.

The Alcond* process, for example
a brand new method of brighten
aluminum without using a conventio
bright dip. Basically, it is a 3-stage p
ess that: 1) Removes any surface fil
2) mechanically polishes and buffs
cleaned surface without redeposit
harmful films; 3) cleans the polish
surface without substantially altering
finish. The work is then rinsed th
oughly and anodized in the usual m
ner. Here are the process steps:

The work is cleaned in an alkal
etch bath; rinsed and dried; polish
with a special compound on a wh
running at about 7000 sfpm; buf
with another special compound or
softer wheel running 7000 sfpm; wip
on a wipe-up wheel running at 7
sfpm or faster; cleaned for 30 seco
to one minute in Alcond CB clea
(1 pound of salts per gallon of wa
temperature of 130°F, alternating c
rent density of 40 asf): rinsed th
oughly; anodized.

If the work is to be coated with cl
or pigmented lacquer, it is necess
only to process it in the Alcond
cleaner, after which it is dried a
lacquered.

A British anodizing company recen
introduced what it calls the "S" proc
for chemical brightening aluminu
This process with its special form
produces a high specular finish
99.8% aluminum alloys and on su
purity aluminum. On magnesium a
magnesium-silicon alloys, the proc
produces bright though less mirror-l
finishes.

Action of the solution takes place o
during immersion time; it stops on
moval, thus facilitating control. A
cous layer created on the surface
the work while immersed drains a
when the work is taken from the b

The solution is based on dilute hy

*By Hanson-Van Winkle-Munning Co., M
wan, N. J.

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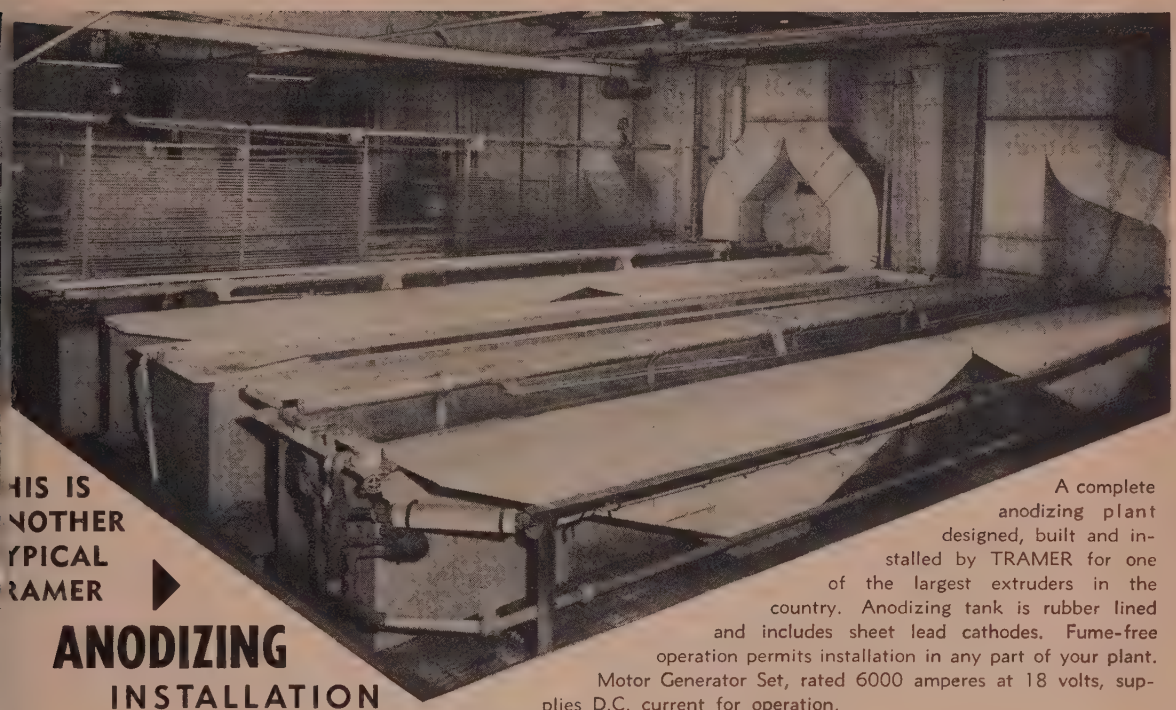

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CASE HISTORY: Chemical Polishing Light Reflectors

Photographic light reflectors must have a high specular finish. These reflectors, products of leading manufacturers of photographic equipment, demonstrate the effectiveness of chemical polishing for mirror-like finishes. These manufacturers use Alchemize, product of Alchemize Corp., Chicago, as the chemical polishing bath (90 seconds at 185° F.) after cleaning and rinsing. After the Alchemize bath, the work is rinsed and dried. Action of the Alchemize bath brightens and smooths the surface of the aluminum. These reflectors were either drawn or spun, using alloys 1100 or 3003. Some are anodized after the chemical polishing treatment. Alchemize Corp. points out that the treatment produces image reflectivity rivaling that of Alzak — but with commercial alloys.

fluoric acid, with certain salts for additives to control the reaction. The process is said to differ considerably in composition and behavior compared with other hydrofluoric acid or fluoride solutions. Treatment time and operation conditions are kept consistent by maintaining solution strength, and by adding hydrofluoric acid as it is consumed.

Sequence of operation is: Clean; brighten; water rinse; acid rinse; and water rinse. Average brightening time is 1 to 1½ minutes, though range of variation can be between 30 seconds and five minutes. The maximum operating temperature is around 70°C.

Large volume processing operations generate considerable heat which must be removed quickly to prevent an undesirable rise in temperature. This means that the brightening tank must have cooling as well as heating elements. Tank size is not less than 150 gallons.

Normal metal removal rate is 0.0003 inch to 0.0006 inch per face minute, depending on operating conditions. For a treatment time of 1 minute, 100 gallons of solution will treat 3000 to 6000 sq. ft. of surface before needing renewal.

The "S" process is reputed to be considerably less expensive than other bright dips that produce comparable results. Not only are the chemicals less costly, but the equipment costs are said to be 50% lower — in Britain, at least.

German Process

The Erftwerk or E. W. bright dip bath developed in Germany uses an ammonium bifluoric-nitric acid solution. It is particularly suited for super purity base aluminum-magnesium alloys. This bath has a very vigorous action and produces definite polishing as well as brightening.

Aluminum parts processed by the Erftwerk process offered an economical substitute for chromium plated steel and brass parts, and was quickly adopted by the German and French car manufacturers. Typical composition of the Erftwerk bright dip bath is:

Ammonium bifluoride	16%	(10-20%)
Nitric acid	13%	(10-17%)
Lead nitrate	0.2%	(.008-.08%)
Dextrin	5-10 g/l	

Operating conditions of the bath are: Temperature, 50-60°C; time, 20-30 seconds; life of solution, 20 sq. ft. per gal. The tank is lined with polythene or rubber and is cooled.

If the ammonium bifluoride contains lead salts as an impurity, this must be allowed for in making up the solution. The treatment has a very vigorous action and thicknesses may be reduced by 0.001 to 0.002 inch, even with the short treatment range mentioned. The addition of dextrin inhibits this action.

The Erftwerk treatment sequence advance of anodizing is as follo Clean, light etch, preheat, Erftw bright dip, HNO_3 dip, anodize, etc. C water rinses must be used between various treatments.

The Erftwerk solution gradually lo its effectiveness due to consumption the ammonium bifluoride and accu lation of aluminum, but may be generated by adding small amounts the salt. Aluminum salts precipitate form a sludge at the bottom of tank, and the bath must be discard after a while.

The brightening action is reported be independent of the degree of wo ing that the bath has received. Tre ment time can be varied from 20 to seconds without significant effect on specular reflectance of the treated wo

Some shops prepare their bright d to other formulas. Here's one:

Phosphoric acid, 80%; nictric ac 5%; and additives. Water is 10% volume. Operating temperature is 220

Here's another:

Phosphoric acid, 75%; hydrogen p oxide, 3½%; water, 21½%—by weig Temperature is 195°F.

Chemical Polishing

Some acid bright dips are more curately described as chemical polishi operations because they smooth out metal surface while brightening to p duce a high specular finish. Chemi polishers will eliminate scratches a fine burrs.

Chemical polishing has grown in i portance in recent years and has be adopted by the automotive indus where it is used prior to anodizi Ford, Chevrolet, Oldsmobile, and oth manufacturers use a proprietary form lation for chemical polishing headlig bezels, grilles and other aluminum pa (see case history). The new Corv will have aluminum parts so treat

Used as a final finish, the chemi polishing process is as follows:

1. Clean work by immersing in a h solution of mild inhibited alkali cleaner. Where the work is very oi precede this step with vapor degreasi solvent cleaning or solvent emulsi cleaning.

2. Immerse in a hot proprieta chemical polishing solution. Immersi time will be dictated by the alloy well as by the surface condition of t metal — buffed, ground, etc., but in a event will be for a matter of seconds.

3. Rinse thoroughly in warm wat right after polishing bath.

4. Rinse in clear running water.

5. Dip briefly in a hot acid pick solution.

6. Rinse in clear running water.

7. Alkaline neutralizing rinse.

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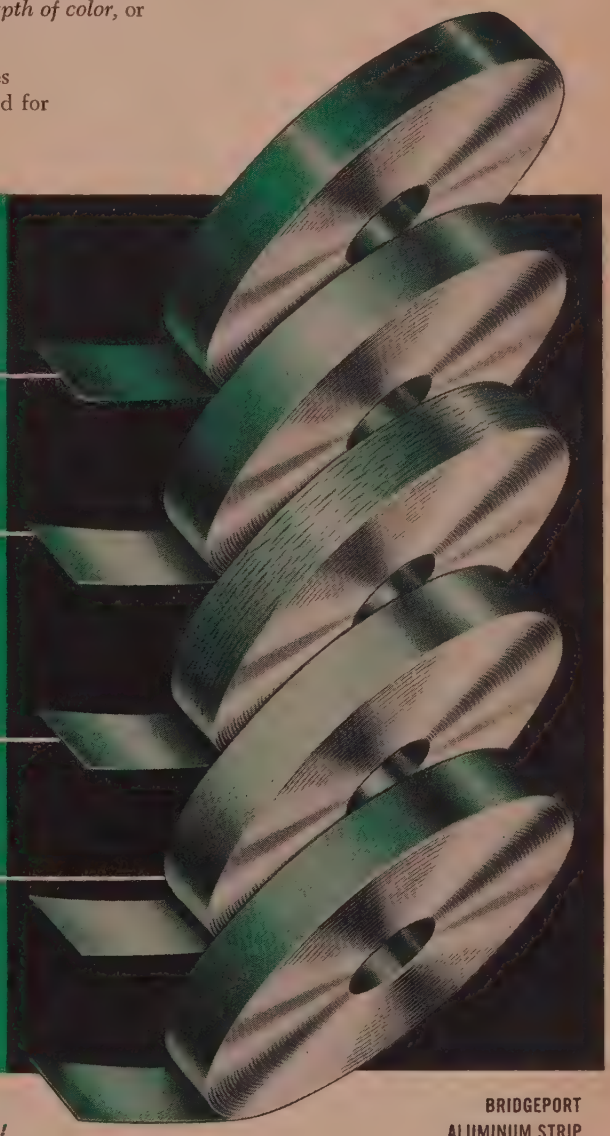

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ANODIZING and PLATING ALUMINUM

pretreatment—electrolytes—coating characteristics operating conditions—racks—coloring—sealing—hard coating—built-in colors—electroplating—special considerations—plating metals—electropolishing processes

ANODIZING is the finishing system most closely identified with aluminum. The exceptionally hard oxide coating induced on aluminum by this process protects the metal against corrosion and abrasion. It is substantially colorless and transparent in most cases, and is sufficiently porous to absorb organic or inorganic dyes of any hue in the spectrum. Whether colored or left plain, the natural metallic sheen of aluminum is retained—and sometimes enhanced.

Anodizing is an electrolytic process; i.e., an electric current and a suitable current conducting medium are required. Other electrolytic processes for aluminum include electroplating and electropolishing. Together, these processes comprise one of the more popular groups of aluminum finishing methods, as revealed by Modern Metals' finishing survey.

Of the 327 plants that reported doing at least some of their own aluminum finishing, 120 employ at least one electrolytic process. Nearly all of these reported anodizing operations, while a few confine their electrolytic processing to plating or electroplating.

Anodizing

Basically, anodizing is a method for accelerating the formation of aluminum's natural oxide coating by immersing the work in a tank containing an acid solution and sending an electric current through the system. The aluminum is made the anode; the tank is the cathode; and the acid solution is the current conducting electrolyte.

The current passing through the solution causes hydrogen to be liberated at the cathode, while the oxygen liberated at the anode combines with the aluminum to form the oxide film.

This film is unusual in that it is created, not applied to the surface of the aluminum. It thickens by growing from underneath. The longer the work remains in the electrically charged anodizing bath, the thicker the coating becomes. However, should the work remain in the bath when the current is shut off, the bath (if based on sulphuric acid) will attack the coating.

For the sole purpose of adding a protective oxide film, the basic anodizing process would involve:

1. Cleaning
2. Rinsing
3. Desmutting (optional)
4. Rinsing
5. Anodizing
6. Rinsing
7. Rinsing
8. Sealing
9. Drying

But where a decorative effect is sought, additional steps are taken — perhaps an etching bath to produce a matte finish, or a bright dip to heighten surface luster. If a mirror-like finish is desired, buffing followed by chemical brightening are performed.

In any case, these are pre-anodizing steps which have been discussed elsewhere in this issue. Only the addition of color to the anodized metal is done after anodizing and before sealing.

Many kinds of acids have been used in the anodizing solution, but the ones most used are chromic, sulphuric and oxalic (this last considerably more popular in Japan and Europe than in the U. S.). Sulphuric acid is most popular because the transparent coating it produces is more suitable for coloring; perhaps also because with it the work can be introduced to the solution at the full requirement of 24 volts or more, despite the immediate current surge caused by the exceptional conductivity of the bare aluminum.

Using chromic acid requires 40 vo which must be applied in stages un the full voltage is attained. Applicati of full voltage all at once would ov load the generator.

After this initial surge, which la only a fraction of a second, ampera remains in the neighborhood of 12 15 amperes per square foot, then creases steadily until the anodizing st is completed.

Porosity of the coating is an imp tant factor when the work is to colored. Degree of porosity is controll by temperature—the higher it is t greater the porosity.

H_2SO_4 Concentration

One anodizer operates his 15-18% c centration sulphuric acid bath at 72° to produce the conventional hard, de coating needed for corrosion resistan When he is running color jobs, he mi raise bath temperature to 85° F. achieve a more porous coating.

This requires less time in the t and the coating isn't as hard as the m dense coatings produced at the lo temperature. He leaves the work in tank longer for dark shades of a c than for lighter hues.

Degree of sulphuric acid concen tion will also affect hardness and p osity of the coating. The greater amount of acid, the softer, more po a coating is produced.

Sulphuric acid concentrations ge ally run between 15% and 25%. following amounts of acid will prod the appropriate concentration:

12 fluid ounces per gallon of w equal 15%.

14.7 fluid ounces per gallon of w equal 18%.

16.6 fluid ounces per gallon of w equal 20%.

(*Continued on page* 84)

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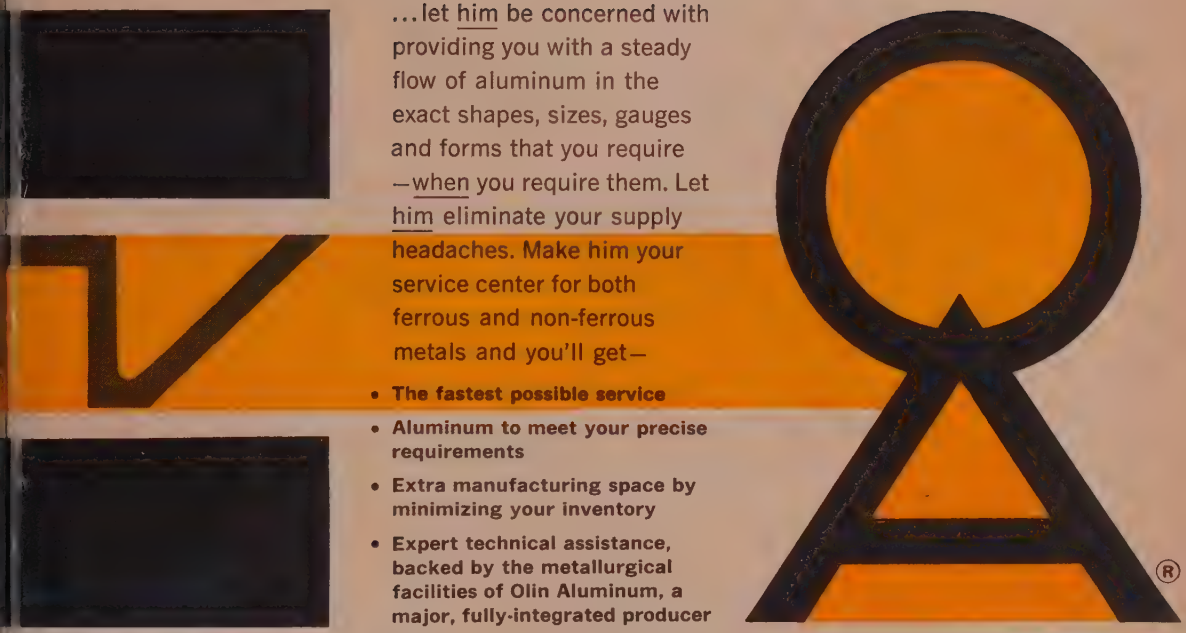
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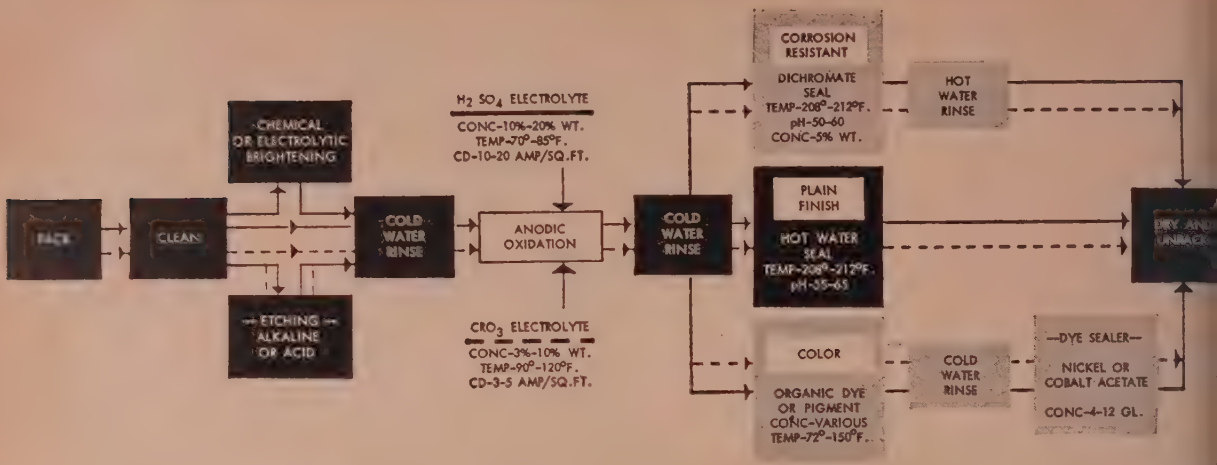
Flow Diagram for an Aluminum Anodizing Installation



21.4 fluid ounces per gallon of water equal 25%.

In the sulphuric acid process these general operating guides might apply.

Temperature — 60-80° F., depending on further processing

Current Density — 10-36 amps per square foot.

Time — 15-30 minutes

Tanks should be lined with lead, rubber, acid brick or Koroseal. Lead linings are said to be a hazard because of eventual cracking or rupture. Where lead lined tanks are used, the lead is the cathode. Where other linings are used, lead sheets about the same surface area as the work to be treated should be used. Lead coils can also be used as cathodes. Aluminum can also be used if they are removed from the tank when not in use.

Heating is rarely necessary, but a large cooling surface is required. Agitation is usually by compressed air.

Anodizing plants almost invariably paint interiors because of the highly corrosive atmospheres generated by the acid bath. Exhaust ducts of acid-resistant material are desirable.

Chromic Acid

Chromic acid anodizing solutions have one advantage in that they become inert immediately upon leaving the anodizing tank. Entrapment of the solution in already assembled products will have no harmful effect. Chromic acid electrolytes also produce an oxide coating which makes an excellent paint base.

The chromic acid solution might have this composition: Chromic acid, 5-10% (6.7-13.4 ounces per gallon of water); sodium chloride, below 0.2 g/l; sulphuric acid, below 0.5 g/l.

Tanks can be of steel with iron pipe coils for heating and cooling and equipped with thermostatic control. Agitation can be by compressed air; exhaust ducts must be installed to carry off fumes.

A direct current generator or rectifier (to change high voltage AC current into low voltage DC) with controls to regulate current between 10 and 40 volts is used. Voltmeter and ammeter are important instruments in this system, but the latest units of the generator manufacturers provide constant automatic low voltage direct current.

Racks

Racking equipment is one of the anodizer's major cost items, the main reason being that most racks are made of aluminum and their service life is brief.

When the aluminum work is anodized, the racks also take on the oxide coating. Since continual build-up of this film impairs electrical contact with the work, the racks must be subjected to a stripping treatment in a caustic bath to remove the oxide.

The frequency with which anodizers strip their racks depends on the type of work, but it isn't unusual for the racks to be stripped after each operating cycle.

The cumulative effect of the stripping treatments is to make the tips of the racks thinner and thinner, robbing them of the tension which holds the work tightly. Hot bright dips, to which racks are continually being subjected before anodizing, also take *their* toll of the metal.

Service life of aluminum racks varies with the jobs they must do and the plants where they are used. But whether they last for 20, 30, or 100 anodizing cycles, the racks must eventually be scrapped and new ones built or purchased.

Rack design is a continuing prob lem. The contract anodizer must kee a large inventory of racks to accomm date the products he regularly handle Whenever he gets a new job, he mu consider whether or not his existin racks can be used. Often enough, h will have to design and build ne ones or have a rack manufacturer d the job for him. In either event, becomes another cost factor in pri ing the new job.

Space for rack storage and manufa turing are other less apparent cost fa tors which the anodizer considers.

The objective, then, is to have rac made of a material that is impervio to bright dips and other compounds an will not take on the oxide coating.

Titanium for Racks

Pure titanium seems to provide th answer. Many captive anodizing plan save substantial amounts of money ea year after the initial outlay for titaniu racks which in most cases cost co siderably more than their aluminu counterparts. Of course, the capti plants have an advantage in runnin the same shape of work all the tim One or two designs will suffice f them. But even job shops are usin certain types of titanium racks adva tageously. One manufacturer has line of all-titanium racks for anodizin small and large parts. Rack design such that they can be adjusted to a commodate product design changes.

All-titanium construction assures th longest possible rack life and elimina the stripping requirement. In som cases, titanium is used only for th fingers of the rack, with aluminum us in heavier sections for the bars. Th extra weight of aluminum causes th part of the rack to last longer.

(*Continued on page 86*)

A new division of
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ere's significant news for everyone who has interest in metals and metal fabrication. The ow Chemical Company, pioneer developers Magnesium and Magnesium products, is w broadening its activities in metal work-g. A new division, THE DOW METAL PRODUCTS MPANY, has been formed to specialize in the mi-fabrication and fabrication of not only Magnesium, but aluminum and other metals. This new division has excellent production facilities, plus knowledge gained through Dow's many years' experience in the metal working field. Facilities include plants for the manufacture of rolled and extruded products, sand and permanent mold castings, die castings, and fabricated assemblies.

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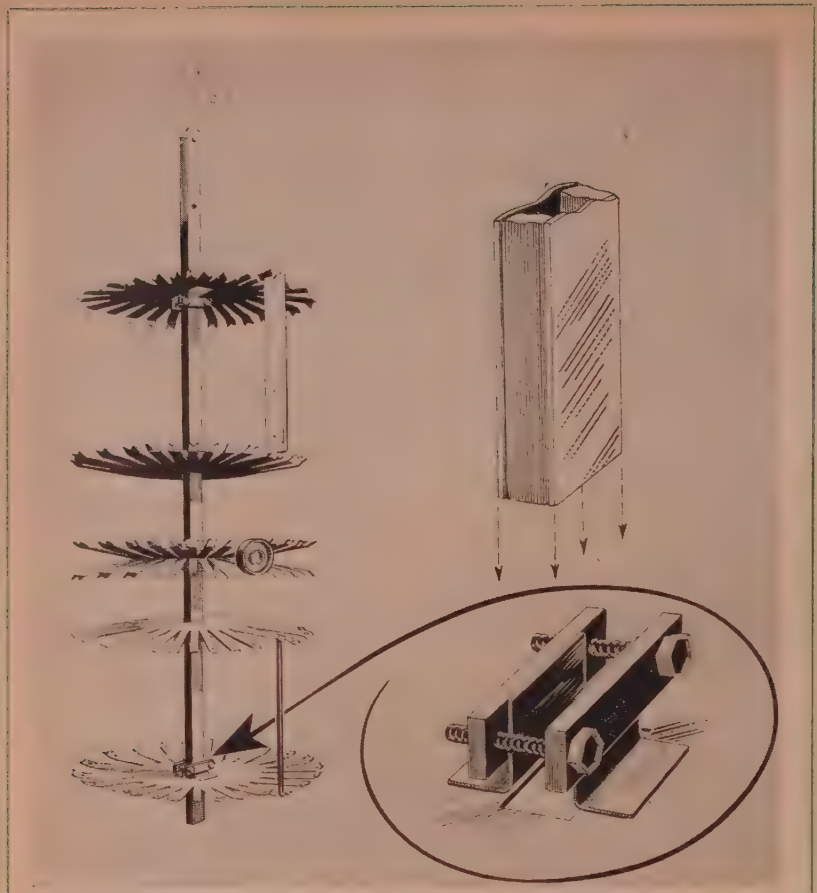

CASE HISTORY: Titanium Anodizing Racks

Newly developed positive clamps and rigid spline make this all-titanium anodizing rack infinitely adjustable for many shapes and sizes of small parts. Each pair of discs can hold up to 30 parts. This rack and others of its general design are used by many large corporations including Frigidaire Division, Western Electric, General Electric. A standard line of titanium racks, including the model shown, as well as special designs are made by the Service-Rack Division of Servi-Sure Mfg. Co., Chicago. The firm also makes aluminum racks. Kinkead Industries Inc., Chicago extruding plant, uses a special Servi-Sure design to anodize 12-ft. lengths of aluminum appliance trim. These racks have been in service for the past two years, with negligible maintenance, no replacement.

Sometimes the aluminum bars are encased in some organic coating, but improper bonding is likely to invite acid entrapment and the hazards of corrosive attack and carry-over of the acid to other tanks.

Commercially pure titanium must be used for the racks. If it contains a certain amount of aluminum, the racks will become anodized. Since titanium is vulnerable to hydrofluoric acid, such solutions should be avoided if titanium racks are used. At least one proprietary bright dip was found to be rough on titanium.

Coloring Aluminum

Colored anodized aluminum has recently developed rapidly for many types of indoor and outdoor applications. Many captive anodizing facilities are engaged in coloring aluminum; auto makers, for example, have large installations of their own.

Because of the colorless, transparent coating produced by sulphuric acid anodizing, most plants engaged in color work use this type of electrolyte in order to get the best color reproduction.

The basic conditions for coloring are as follows:

Electrolyte — 15% to 25% sulphuric acid, with the average from 16% to 18%.

Temperature — 72° F. for gold and other light colors; between 80° and 82° F. for darker shades.

Bath Time — from 5 to 10 minutes for light colors; one-half hour or more for dense colors and black.

Current density — 12.5 amps pe square foot.

Voltage — 16-18 volts, DC.

Color objectives are achieved by co trolling the porosity and thickness the oxide coating. Porosity is varied b composition of the electrolyte and i temperature. Coating thickness is go erned by the length of time the wor is kept in the electrolyte. Also, with th electrolyte at constant temperatur porosity and absorption properties the coating increase as acid concentra tion increases.

However, keeping the aluminum i the electrolyte too long produces a over-thick coating which, when seale produces a dusty appearance.

Prior to coloring, the electrolyte mus be thoroughly rinsed off the surfac of the work. This is usually done wit warm running water.

Preparing Dye Baths

Manufacturers of dyes have produce a broad range of products for colorin anodized aluminum and give detaile directions for their use. General dy bath conditions are as follows:

Dye concentration is from one t three grams per liter of water for ligh shades; five grams per liter for black Bath pH varies with the dye but i usually 5.0 to 6.5. Operating tempera ture is 150° F. for 10 minutes to on half hour.

To prepare the dye bath, first dissol the dye in an equal amount of col water (distilled or deionized water preferred), and after the paste is forme add boiling water, stirring constant until complete solution is attained.

The best dye absorption in the oxid film is achieved at 150° F. If the tem perature is reduced immersion tim must be extended in order to obta equivalent coloring. If the temperatu is raised above 150°, the absorption ra increases but the operator runs the ri of presealing the film with a loss color value.

Discover Best Time Cycle

Absorption rates vary with the d used, so the time cycle is best det mined by experimentation.

When the operator is unable to tain the shade or color match desire he may be successful by mixing dy However, such factors as absorption ra pH solubility, and other characteristi of the individual dyes must coincide closely as possible. If this is not o served, the dye with the faster abso tion rate will become exhausted soon resulting in an off-color bath. Wh this occurs, addition of the faster sorbing dye must be made to rest the bath to its proper color.

When a dye job proves faulty,

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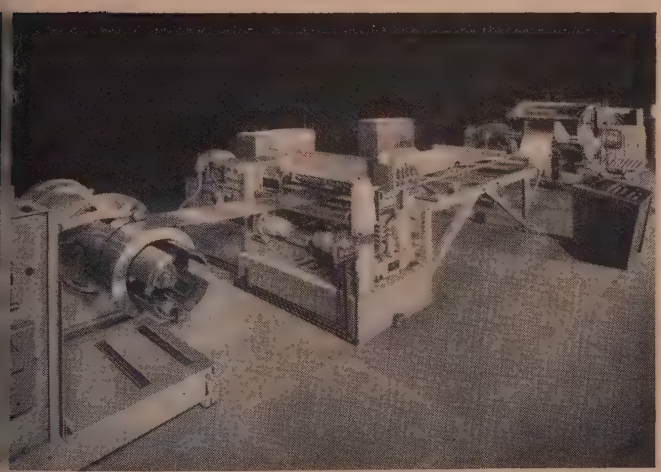

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coloring can be removed from the anodic film before sealing. Depending on the dye used, this can be done by immersion in a solution of sodium hypochlorite containing 1% available chlorine; or in a bath of 30% nitric acid at room temperature for three minutes. The metal is then rinsed and re-dyed.

If coloring jobs are found to be faulty after sealing, the coating can be stripped in caustic solutions. Such a bath atacks the base aluminum, however, and safer baths are available.

One solution is composed of phosphoric acid (85%), 50 ml.; chromic acid, 30 grams; up to 1 liter of water. Bring to a boil.

Another bath is made up of sulphuric acid concentrate, 250 ml.; antimony trioxide, 2 grams and one liter of water. This solution leaves a black precipitate of antimony on the surface which can be taken off with a dip in 30% nitric acid. Polishing and degreasing can precede re-anodizing.

Sealing the Color

A thorough rinsing in warm water follows dyeing to prevent contamination of the sealing bath. Sealing normally consists of immersing the coated aluminum in boiling water for five to 10 minutes. This closes the pores of the film and keeps the color from leaching out. Once the work is sealed, it can be handled with no adverse effect on the metal surface.

The use of special sealing bath solutions, however, assures superior color fastness. A typical bath contains 5 grams of nickel acetate and 5 grams of boric acid per liter of water. The pH is 5.0-5.8, adjusted with acetic acid.

The sealing bath is maintained at 200° F. to a gentle boil, and the work is held in it for 2 to 10 minutes. Rinsing and drying complete the operation.

For best results, the rinse and sealing baths should be made up with deionized water. (In fact, it's good practice to use deionized water in anodizing and plating solutions, as well.) The trouble-making ions are often removed from water by using ion exchange resins.

The use of deionized water will avoid the entrapment of dissolved compounds in the sealed oxide coating. This not only prevents unsightly water stain, but also increases corrosion resistance of the finish.

Built-in Colors

While the architectural field has for years afforded a huge market for anodized aluminum, use of the highly colored anodic coatings has lagged because of their vulnerability to strong sunlight.

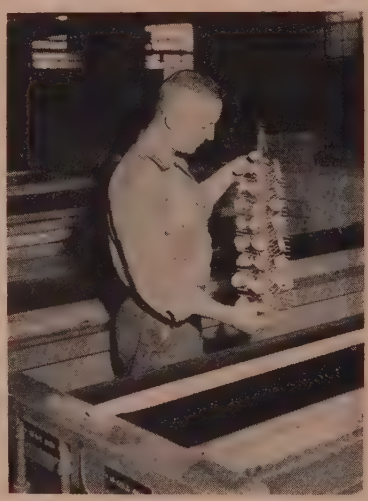
This is not to say that chemically induced anodized color is a complete failure in outside exposure; auto makers have made good use of gold shades for car trim.

Most successful have been the gold shades obtained by using a ferric oxide pigment. The most noteworthy colors achieved by this stable, inorganic pigment are yellow, orange and brown.

A rich black can be produced by the precipitation of metallic sulfides in the anodic coating (this is a two-step operation though). Other colors can be obtained by precipitating metallic chromates or permanganates, but there are practical problems to be solved which have curtailed extensive commercial use, mainly cost factors and problems of control.

Although ferric ammonium oxalate precipitation is carried out in one step after anodizing, most other pigment precipitates require multi-step processes and are therefore difficult to control for uniformity of color.

Recent years have seen a second approach to light-fast color. It has long been known that aluminum alloys containing silicon turn dark gray when anodized in sulphuric acid solutions.



CASE HISTORY: Color Anodized Aircraft Parts

Ever since Eastern Airlines specified gold anodized aluminum details for its aircraft interiors a few years ago, the aircraft industry has moved steadily in this direction. Complete interior trim items such as ash trays, panels, lighting fixtures, airvent filters, window frames, moldings and other aluminum hardware have been anodized in gold and in other colors from light pastels to dark blues and gun metal. Quality control requirements are high, approaching that of jewelry finishes. In the picture, parts are inspected for proper racking before immersion in color dye tank at Anadite, Inc., South Gate, Calif.

By proper control of the silicon c stituents, aluminum producers h been able to market a series of silic alloys that take on colors ranging fr light grey to almost black when a dized. These finishes have been c standingly successful in architectu applications.

In an even more ingenious approa the unattractive light yellow discolo tion of anodic coatings in chromi bearing alloys was converted to a vir through the control of chromium c tent and metallurgical structure.

The result of research carried on Kaiser Aluminum's Department of M allurgical Research is an alloy wh takes on attractive shades of light- gold directly upon anodizing in phuric acid baths without additio dyeing.

This "gold anodizing" alloy, pat rights for which are held by Kaiser, recently been put on the market Kaiser Aluminum No. 80 architectu sheet and has already appeared or number of buildings. Broadest use date has been in the curtain walls the new Kaiser Center, now near completion in Oakland, Calif.

Hard Coating

A third approach to light-fast co is an outgrowth of the production hard, abrasion-resistant anodic coati by anodizing in modified sulphuric a baths at low temperatures. This proc dates back to World War II, and th coatings serve admirably in many ite of equipment.

The hard coatings on many all were olive or gray-black in color, pending upon the coating thickn These colors were considered unde able for decorative use, but archite have recently begun to use them.

But present hard coating meth have limitations: Anodizing must carried out in a low temperature b and at anodizing voltages that are so times dangerously high. In addition, range of color is limited, and the dar colors require heavy coating thickness up to five mils. Such thick coatings highly strained and may craze ba under thermal or mechanical stress.

Another new method of produc colored anodic coatings on alumin alloys has been under intensive resear and pilot development now is close the point of commercial developme Kaiser Aluminum reports that th coatings should provide the desig with an exciting new medium.

Electroplating

Electroplating is not used on alu num as often as on other metals such steel and zinc. The main reasons fairly obvious:

1. Aluminum's natural good looks a

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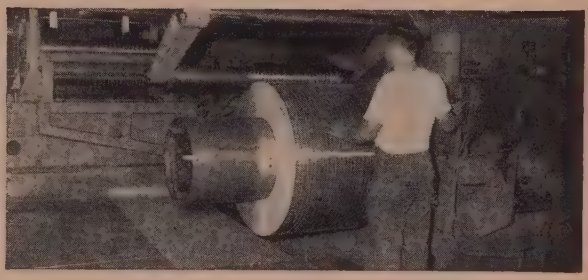

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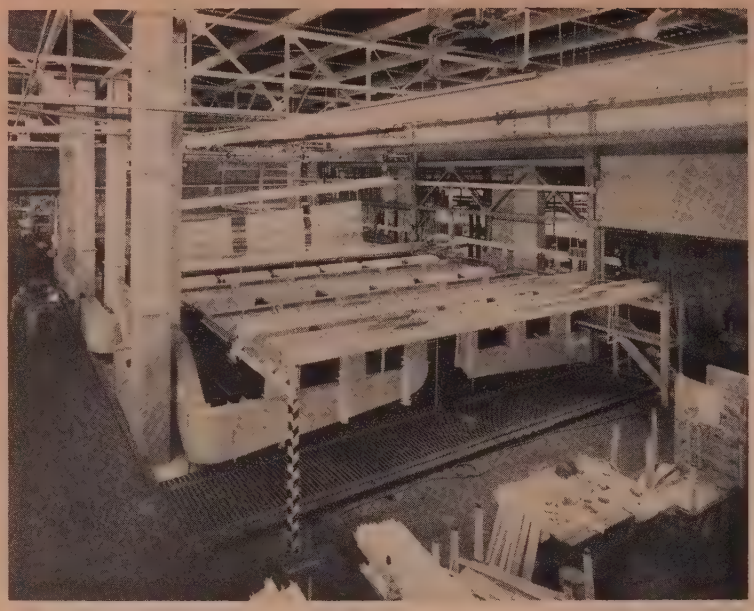

CASE HISTORY: Anodized Building Products

Expanded facilities for production of anodized building products are now in operation at the Elkhart, Ind. plant of Adams & Westlake Co. Almost fully automatic, the new installation is expected to triple production and raise product quality. The quarter million dollar metal finishing system has a total of twelve 30-foot by 7-foot tanks, served by two remote controlled bridge cranes. Notice effective fume exhaust system.

innate resistance to corrosive attack obviate the need for decoration or protection in many applications.

2. Where decoration or protection are required, other processes such as anodizing, conversion coating, enameling and the like can usually do the job—and at moderate cost.

Nevertheless, electroplating can be used to advantage on some aluminum products. More and more plating shops are finding that aluminum is just another metal that will take an electrodeposited metallic coating. They generally use their regular plating equipment, but the procedures for aluminum are usually different.

Special Considerations

There are two special considerations that must be borne in mind when electroplating aluminum. These are:

1. The tough, tight oxide skin that protects aluminum against corrosion also "protects" the metal against plating. This skin must be either removed or modified before a satisfactory plate can be deposited.

2. Since aluminum is anodic to most plating metals, any discontinuities in the plated coating might create a galvanic cell effect. (The presence of an electrolyte such as chemically contaminated water can cause sacrificial corrosion of aluminum and ultimate destruction of the finish.) For this reason, plating shops make certain that plated coatings on aluminum are especially dense and non-porous.

Conscientious platers take pains to avoid entrapment of plating solutions in complex parts or assembled products made of any metal. This is particularly important with aluminum because of the galvanic corrosion factor.

Since the electroplating of aluminum is usually done for decorative effect, the physical condition of the surface to be plated is of utmost importance. A high specular chrome plate, for example, would only serve to accentuate the rough spots in an improperly prepared surface.

The materials, equipment and techniques used to create various surface conditions are covered in the Mechanical Finishing Section (page 48) of this issue. Chemical and electrochemical polishing methods, including numerous proprietary processes, can also yield excellent results. It is also good practice to electropolish after each plating sequence in multi-plate finishing.

The problem of aluminum's oxide skin is usually taken care of by the zinc immersion process. This process dissolves the oxide film a places it with a thin, tightly ad coating of metallic zinc. Subs electroplates are then applied c zinc by conventional methods.

The usual procedure is to pr the aluminum parts by vapor d ing or immersion in a mild al solution, then dip them in a h mild solution of caustic soda; ri cold water; dip in nitric acid so (this removes etch stains); then di the zincating solution.

This solution normally consists grams of caustic soda and 100 gr zinc oxide per liter of water. Bat perature at 70-80° F (too high perature will cause the zinc dep be loose and granular). Some add a small amount of Rochell (from 1 to 1.5 ounces per gal water) to promote deposition of uniform zinc coatings.

Vigorous agitation of the bath sential; otherwise, the parts may d dark gray spots, in which event necessary to strip the coating i centrated nitric acid and apply th ate treatment again. Since the bath is very viscous, double rins used to remove all solution fro aluminum parts. As in all plating tions, the running water rinse ferred.

Preparation Important

All of the preparatory steps a tremely important; the success electroplate is largely dependent the condition of the aluminum s before it enters the plating bat contaminants must be removed a zincate coating must be uniform tightly adherent.

Metals that are electrodeposit aluminum include copper, chro nickel, tin, cadmium, silver and Whatever the final finish, it is practice to apply a light copp nickel strike first. The copper st applied in a low pH Rochelle so made up as follows: For every of water add 5.5 ounces of coppe nide, 8.0 ounces of Rochelle Sa ounces of sodium carbonate, a ounces of sodium cyanide.

Hold the bath at 80-120°F and sure that the aluminum parts are for positive electrical contact they are immersed (otherwise, th ate coating may be stripped befo plating action begins). A current d of 20 to 24 amps per sq. ft. is a for about 2 minutes, after whic density may be reduced to 8 to 12 per sq. ft.

The resultant copper plate may from a .0005-inch color coat to a

uffing coat. A copper plate is
nes applied to aluminum parts
e to be soldered (there are easier
o prepare aluminum for solder-
owever).

strous chromium finish can be
l to aluminum by chrome plating
buffed copper plate, then buffing
al chrome finish. The chromium
made up of 53 ounces of chromic
id 0.5 ounces of sulfuric acid for
allon of water. Bath temperature
25°F and current density is 200-
mps per square foot at 6 to 8
f chrome is to be applied directly
he zincate film, a much cooler
(65-70°F) is used at first, after
the above procedure is followed.

g Metals

ough copper and chromium are
etals most commonly plated on
um, other metals are also ap-
or specific purposes. A cadmium
oat is applied in a solution con-
8 ounces of sodium cyanide and
e of cadmium oxide per gallon
er. The bath is held at room
ature and current density is 25
per sq. ft. Immersion for 1 or 2
s will do the job.

a heavier cadmium coating, the
s plated in a solution containing
nces of cadmium oxide and 14.5
of sodium cyanide per gallon of
Brightener is added as needed.
ath is also held at room tempera-
out current density ranges from
5 amps per sq. ft. at 1 to 4 volts.
ood practice to use cadmium ball
in this bath.

main advantage of cadmium
lies in the fact that this metal
t cathodic to aluminum. The
of galvanic corrosion, therefore,
iderably lower.

s is sometimes plated on alumi-
or either decorative or functional
es. For every gallon of water in
ating bath, add 4 ounces of cop-
anide, 1.25 ounces of zinc cyanide,
nces of sodium cyanide, and 4
of sodium carbonate. Current
is 3 to 5 amps per sq. ft. at
volts, and the bath is held at
F. If operating conditions are not
ithin close limits, uneven color-
the brass may result.

lver is to be plated on aluminum
rally for electrical contacts re-
extremely low surface resistance
ver flash coating may be applied
oom temperature solution made
.5 to .7 ounces of silver cyanide
to 10 ounces of sodium cyanide
llon of water. Current density is
25 amps per sq. ft. at 1.5 to 3

is followed by silver plating in

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a solution containing 4 ounces of silver cyanide, 4 ounces of sodium cyanide and 6 ounces of sodium carbonate for each gallon of water. Solution temperature is 75-80°F and current is 5 to 15 amps per sq. ft. at 1 volt.

No discussion of electroplating on aluminum would be complete without mention of some proprietary processes that have enjoyed wide acceptance. The Unichrome* process, for example, employs an alkaline, bivalent copper plating solution that is made up and maintained with specially prepared salts. The bath operates through a wide current density range and is said to produce a tightly anchored copper deposit which is smooth, bright and ductile.

The zinc immersion treatment is not required when plating aluminum with the Unichrome process. The usual pretreatment is phosphoric anodizing (which may be used as a base for some other electroplated coatings, as well.)

Phosphoric Anodizing

Phosphoric anodizing is essentially similar to other anodizing processes (see preceding section), except that a 55-60% solution of phosphoric acid is used at a temperature of 85 to 90° F. Parts are first cleaned, rinsed in cold water and hot water, then immersed in a hot caustic soda solution for half a minute, and then rinsed in cold water. The parts are then anodized in the phosphoric acid bath for 5 to 15 minutes. Current (DC) ranges from 5 to 30 volts.

After anodizing, the parts are copper plated in the Unichrome bath in accordance with instructions published by the manufacturer. The resultant copper coating may serve either as a final finish or as a base for subsequent electrodeposited coatings.

The Alumon process,** a proprietary variation of the zinc immersion treatment, removes oxide from the aluminum surface, activates it, and deposits a firmly adherent zinc-copper base deposit for electroplating.

No electric power is used, but the process requires three additional tanks—a steel one for alkaline cleaning, an acid resistant tank for desmutting dip, and a steel tank with cooling coil for the Alumon solution. Cold water rinses are required after each step, and a copper or nickel strike is recommended before electroplating.

Still another preplate treatment for aluminum is the Alumetex process#, which employs a non-etching alkaline cleaner, two acid etches, an immersion coating, and a final copper strike. Cold water rinses are specified after each of these steps, and a neutralizing acid dip is recommended for parts that are d cult to rinse.

The process is said to provide a s able base for all electrodeposited c ings on all commercial aluminum loys. Alloys containing magnesium quire a slightly different procedure.

Various suppliers of finishing ma rials have proprietary zincate prepa tions that are said to have special vantages over the conventional z immersion bath. An example is Al lume Pre-Plate* which is said to depo an "extremely fine grained, unifo coating in one pass." The low surf tension of the bath minimizes drago according to the manufacturer, and tolerance for chrome assures continu operation and longer bath life.

Other Electro Finishes

Highly specular finishes for a vari of products can be achieved with Alzak process. This involves an elect polishing step using a 2.5% solution fluoboric acid as the electrolyte. Ba temperature is about 85° F., with a vo age of 15-30 and a current density about 10-20 amps per sq. ft. Immersi time is 5 to 10 minutes.

This treatment produces a surface flectance of about 85% on high-pur aluminum. The surface produced this electropolishing treatment usua calls for a final anodizing treatment surface protection. This is genera done in a 7% solution of sulphu acid at a current density of about amps per sq. ft. at 20 volts, and immersion time of 10 to 20 minutes

Sealing the oxide film is done hot water (180-212° F).

The Brytal process is another pate ed treatment that produces high spe lar finishes on aluminum. The work first electro-brightened in an alkali solution of 15% by weight of sodiu carbonate and 5% by weight of sodiu ortho-phosphate in water. The pH mu be at least 10.

The bath is first used as a pickli agent in that the current is not i mediately applied. The bath is ma tained at 170-180° F. and current de sity is 20-30 amps per sq. ft. at 10- volts. Treatment time is 10-15 minut The work is then thoroughly rinsed ter which it may be anodized in bath of sodium bisulphate (5-40% weight) to give it a clear, transparer protective film. This bath is operat at 70-120° F. with a current density 5 amps per sq. ft. Treatment time 10-15 minutes.

The highly reflective surface pr duced by these processes have good c rosion and abrasion resistance, a stand up well in outdoor service.

*By Metal & Thermit Corp., Rahway, N. J.

**Patented by Enthone, Inc., New Haven, Conn.
#By MacDermid, Inc., Waterbury, Conn.

*By Northwest Chemical Co., Detroit 4.

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ORGANIC COATINGS FOR ALUMINUM

cleaning methods — surface pretreatments — primers — etch type primers — types of finish coats — spray painting — hot airless spraying — airless electrostatic spraying — steam spraying roller coating — dip painting — flow coating — baking — drying.

PAINT is no longer an adequate term for the long list of organic coatings available today to metalworking firms. Within the past few years, the research and development activities of the chemical and plastics industries have brought enormous strides in the technology of organic coating.

Not so many years ago, the conscientious finishing engineer had to familiarize himself with a mere handful of organic coatings and three or four coating methods. Today, he must deal with such exotic materials as acrylics, butyrates, epoxies, methacrylates, silicones and vinyls, as well as sophisticated application methods such as electrostatic spraying, continuous roller coating, and the like.

The popularity of organic coating in the metalworking industry is borne out by the results of Modern Metals' recent finishing survey (see pages 35 and 36). Of the 327 plants that reported at least one cleaning or finishing operation, an even 200 (61%) do some type of organic coating.

As might be expected, spray painting came out on top by a substantial margin. Fully 155 plants reported that they apply organic coatings to aluminum by some spray method. Dip painting was reported by 41 of our respondents, while 34 have roller coating installations and 18 do plastic laminating. Clear coatings of one type or another are applied by 110 of the firms that replied to Modern Metals' questionnaire.

Aluminum responds well to decorative coating with organic finishes. In fact, it is generally easier to protect with paint than are other metals because of its innate resistance to corrosion. As is the case with other finishing systems, however, some pretreatment of the metal surface is usually necessary.

If the coating is applied for decorative purposes alone, pretreatment may entail nothing more than a thorough cleaning of the surface. If protection is the objective, a more elaborate sequence of operations will be required. If a transparent coating is to be applied, you'll want to make sure that the surface is free of stains and blemishes that would otherwise show through.

Some aluminum alloys appear to have better paint adhesion than others. For example, alloys 1100, 3003, 5052 and 6061 seem to be superior in this respect to 2024 and 7075. Proper preparation of the surface plus the use of a good inhibitive primer will even up the score on this count, however.

It's Gotta Be Clean

Whether the coating is applied for decoration or protection, a clean surface is a prerequisite. A thorough swabbing with solvent might do the job, but it's risky. A thin film of grease is almost certain to remain on the surface after the solvent has evaporated.

Vapor degreasing and/or cleaning in one of the proprietary cleaners (see table on page 40) will produce more reliable results. Cleaning and roughening of the surface (to provide "tooth" for the coating) may be accomplished simultaneously by abrasive blasting, scratchbrushing or some other mechanical operation.

This is rarely recommended, except in cases where wet or vapor blasting with extremely fine abrasives can be performed. With shot blasting or abrasive blasting, you often run the risk of distorting the workpiece, particularly if it is made of light gauge sheet.

It is important to remember that many of today's fine organic coatings will faithfully reproduce some surface irregularities such as deep tool marks, die lines, porosity, etc. Thus, it may be necessary to perform some mechanical finishing operation such as grinding, polishing, barrel tumbling, and the like. Details on these operations are provided in the section beginning on page 48 of this issue.

Surface roughening may also be accomplished by etching, usually in an alkaline bath. (For details on caustic etching, see the section beginning page 64.) In some cases, it is necessa to remove aluminum's natural oxi coating before applying an orga finish. With heat treatable alloys, example, the film must be removed fore conversion coating. Acid etchi is often used for this.

The best paint adhesion and c rosion protection are provided by o of the many excellent chemical electrochemical treatments. These pr esses run the gamut from immersi in a simple aqueous solution of ph phoric acid to the more complex a odized finishes.

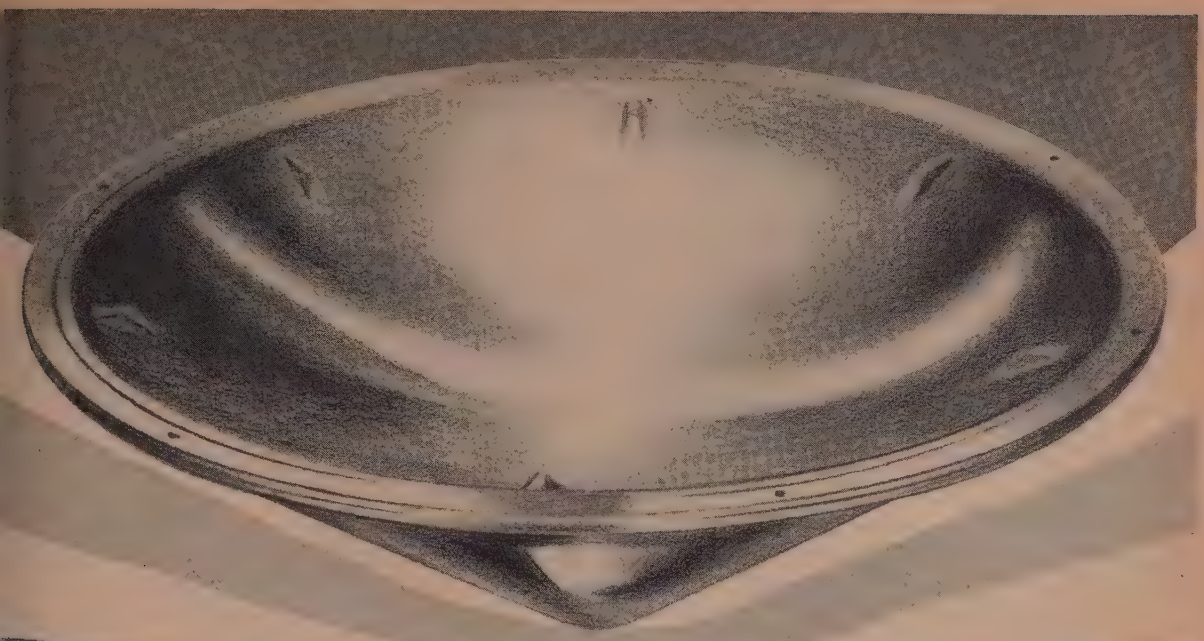
Somewhere between these two tremes are the proprietary conversi coatings of the phosphoric and chron type. Besides providing a superior bo for paint or lacquer, these treatme (see table on page 74) create an in surface coating that serves as an eff tive barrier against any moisture th might penetrate the paint and corro the base metal.

When conversion coatings are us it is normal practice to rinse the treat metal in a highly diluted bath chromic or phosphoric acid. The wo is then given a water rinse and th oughly dried before applying the pri coat (if used) and finish coat.

It is particularly important that t surface be completely dry; the presen of trace amounts of water can ruin otherwise perfect finish. Castings shou be dried by heating so that all wa is driven out of minute pores. If sembled products are to be coated, a good idea to make sure that no wa is lurking in small, concealed crevic

If you can justify the expense anodizing before painting, the ox film created by this familiar proc will serve as a highly efficient base paint. Needless to say, it also enhan the corrosion resistance of the produ The application of a coating of cle colorless lacquer over anodized alu num products is becoming rather co mon practice.

(*Continued on page* 96)



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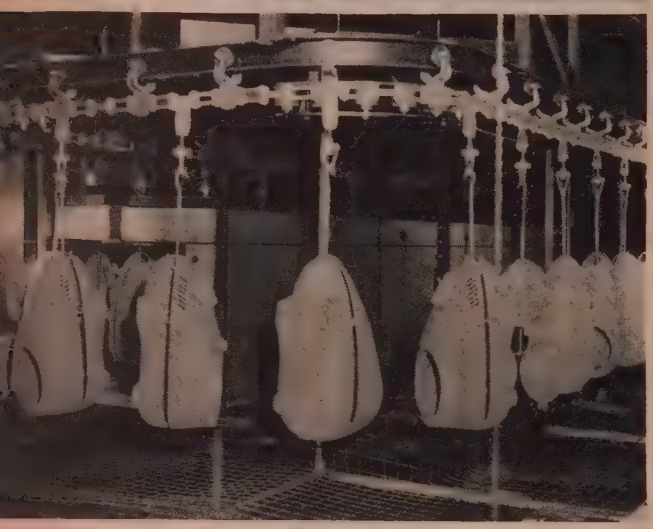

CASE HISTORY: Electrostatic Spray Painting Aluminum Die Castings

Housings for the Compact vacuum cleaner made by Interl cision Products Corp., Anaheim, Calif., are automatically spray In upper left photo of overall degreasing, preheatng and area, units are entering degrease section at upper right o will be preheated, then go to painting (background of pho to heating (160-180° F. for uniform coating), chips from dr blown off work by compressed air system. In photo above, and lids are sprayed by four single head units of a Ransbu process system, using Interchemical Rincontrol Green Wrink A uniform coating, 7 mils thickness, is put on. Parts are as they pass through electrostatic spray area. Interstate g its paint mileage with the switch to this process. In photo, le parts are shown emerging from overhead electric radiant ov timers are used to hold temperatures between 160 and 38 20 minutes. Wrinkle finish is achieved by controlled flash-o parts are baked. They'll go to the assembly line, cooling as Conveyor line is equipped for quick changeover; Intersta components for two other floor care products.

When maximum paint adhesion and corrosion protection are sought, a prime coat generally precedes the finish coat. The properties to look for in a primer include good adhesion to aluminum, good corrosion inhibiting characteristics, resistance to moisture, good flexibility, and compatibility with the finish coat.

A Prime Primer

One material that fulfills all of these requirements is the familiar zinc chromate primer. This consists of zinc chromate pigment (at least two-thirds of total pigment content) in a base made up of phenolic resin, alkyd resin or both. Properly compounded and applied, it will dry sufficiently for handling within five minutes. It can be applied by all of the conventional methods.

Unpigmented phenolic primers are sometimes used on aluminum, and some applications such as appliance parts may call for an alkyd primer pigmented with titanium dioxide. Aluminum paint serves well as a primer in some instances. Other pigments such as iron oxide and strontium chromate have been used on occasion. No lead base pigments should be used in primers for aluminum.

Most prime coats may be either air dried or baked, although some suppliers recommend baking of their proprietary primers if the top coat is to be baked. It is not good practice to use a primer as a finish coat, particularly if the product is to be exposed to weather. And don't let primed parts stand too long before applying the finish coat. The prime coat will continue to harden and adhesion of the top coat may be impaired.

Many suppliers of proprietary primers report that their products may be used in lieu of pretreatments such as conversion coating. Better check this out carefully, however, if your product must withstand an aggressive environment. Best results are obtained by both conversion coating and priming.

A fairly recent arrival on the scene is the so-called wash primer, consisting of zinc chromate in a polyvinyl butyral vehicle. Dilute phosphoric acid (or phosphoric acid plus alcohol) is added just prior to use. The primer etches the metal slightly to produce a "tooth" and a phosphate film for tighter adherence. One trouble with this material is that it will not keep long; the acid attacks the rest of the components in the prim

One vital factor to consider in sel ing a primer is its compatibility with finish coat. It must be immune to cessive softening or lifting by the vent used in the finish coat.

Plenty of Finish Coats

As mentioned earlier, the finishi engineer can select his finish coat fr a long list of paints, enamels and l quers. These may include not only well-known natural oil base paints, b any of a broad range of natural a synthetic resin base coatings, as well.

In the modern lexicon, the ter "paint" and "enamel" are generally terchangeable. They both refer to coating material made up of pigmer vehicles and solvents. The pigments i part hiding power and texture as w as color. The vehicles are the oils synthetic resins that act as carryi media. The solvents serve to dilute t vehicles to varying consistencies for c ferent application methods.

Other components may occasiona include wetting or activating agents th enable the vehicle to combine with t pigment, or other additives that imp

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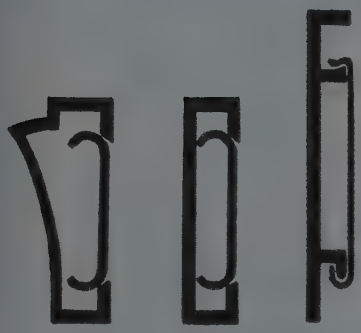

SNAP-ON MOLDINGS

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SAE

CASE HISTORY: Bake-Drying Enameled Aluminum Roofing Shingles

Thermosetting synthetic enamels are bake-dried on aluminum shingles, roofing and siding used in the Viking prafabricated aluminum homes made by National Homes Corp. Shown here is the 84-ft. driQuick infra-red oven (Dry Clime Lamp Corp., Greensburg, Ind.) taking a conveyorized load of shingles. The oven processes 25,000 sq. ft. of shingles per 8-hour shift. Temperature regulation in 16 different zones by cyclical controllers permits processing of wide range of coating systems requiring diverse heating schedules. Temperature in each zone can be varied between 0 and 100% of rated power and to within 1° of required temperature.

special effects such as luminescence.

Lacquers usually consist of natural or synthetic resins diluted in the appropriate solvents. They may also contain drying oils. Lacquers are sometimes tinted for special effects—to give aluminum a gold or brass hue, for example.

Synthetic resins have all but taken over the organic coatings field. The alkyds alone are believed to account for over half of the resins used in organic finishes. The synthetic resin family also includes the acrylics, butyrates, epoxies, vinyls, methacrylates, melamines, polyesters, and others. Some have air drying vehicles; others require baking.

The selection of the best vehicle for a given application involves too many factors to be covered in a discussion of this scope. Suppliers of the materials are the best source of advice on this matter.

Alkyds Most Popular

The alkyds and modified alkyds are the coatings most commonly used on aluminum. They are durable, highly adhesive, flexible enough to withstand fabrication, and relatively low in cost. In outdoor exposure, they do not chalk when exposed to sun and moisture. When modified with phenolic resins, they exhibit improved resistance to alkali and water. Though the alkyds air-dry rather slowly, drying can be speeded up by baking.

The relatively new thermosetting acrylics generally offer better properties than the alkyds, but they require bake-drying and cost somewhat more than alkyds. When applied over a suitable conversion coating and/or primer, these enamels provide an excellent finish for aluminum building products that are exposed to weather.

Epoxy-based coatings have excellent adhesion to aluminum, but may be prone to chalking when exposed to extreme weather. Some of the more recent epoxies have been formulated expressly for outdoor exposure, however. The urea-formaldehyde and phenolic epoxies must be bake-dried.

Vinyl coatings are widely used on aluminum products. They adhere well to aluminum, and have excellent flexibility for fabrication after coating. Some vinyl coatings exhibit rather poor color retention in outdoor exposure, and their heat resistance is not as good as some other organic coatings.

Among the clear lacquers, the methacrylates adhere well to aluminum and form a coating with good weathering properties. Their heat resistance is poor, however. Half-second butyrates make good air-drying clear lacquers for aluminum (see case history on page 100) and are relatively low in cost. Their film life is said to be very good, and they can be tinted for special effects.

Most suppliers of enamels will generally concoct a specific formula for a specific application—particularly if production runs are high as in the case of siding, awnings, blinds and other building products. Since many of these firms have a full stable of coatings based on several of the synthetic resins, they can offer reliable advice on the type of coating best suited to your particular application.

How to Apply It

Enamels and lacquers are applied to aluminum by all of the conventional methods—spray, dip, roller coating and flow coating. Equipment is the same as that used for other metals.

As indicated by replies to Mode Metal's finishing survey, spray painti is by far the most commonly us method. There are several spray met ods, the most common being compress air spraying with a manually or aut matically operated gun.

Others include electrostatic sprayi (see case history on page 96), hot airl spraying, and steam spraying. Of the electrostatic spraying seems to be gai ing favor the fastest—in the aluminu industry, at least.

Conventional gun spraying may e ploy either of two types of equipmer The suction feed gun is generally a tached to a pressurized tank which co tains the enamel or lacquer. Since t container requires frequent refillin this type is less efficient for large-volu work.

The pressure feed gun is powered b an external compressed air source. E amel or lacquer is also fed to the gu from an external source. A plain rubb hose usually carries the compressed ai while the fluid hose must be made of material that will resist the coati materials and solvents.

Sources of Trouble

Many spray coating defects origina at the gun. This precision instrume must be cleaned frequently (after eac work day, at least) and should be adjus ed to project a symmetrical pattern evenly spaced and uniform sized pa ticles of coating material on the wo surface.

The compressed air source can al cause trouble, particularly if it fails deliver air at a constant volume a pressure. When the compressor serv several guns, maintenance of unifor

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CASE HISTORY: Clear, Protective Coating

The aluminum walls of the plant of American Sterilizer Co. had three years' exposure to industrial film and consequent pitting. Original sheen of the metal was restored; Alodine 1000 was applied as a base, after which a clear, colorless lacquer based on half-second butyrate by Eastman Chemical Corp., was sprayed on to prevent recurrence of discoloration. The butyrate coating is Pyroxcote, by Pyroxylin Products Co., Chicago.

pressure and volume becomes especially critical.

It is also important to make sure that condensed water is removed from the air lines before it reaches the gun. The usual approach is to install an air transformer which not only adjusts air pressure to the gun, but also removes water, oil and other foreign matter from the line.

Suppliers of spray guns, air compressors, regulators and other equipment provide complete instructions on proper spray techniques and maintenance of spray equipment.

Electrostatic Spraying

Pressure spraying is sometimes used in conjunction with an artificially induced electrostatic field to insure uniform distribution of coating over the workpiece and to minimize overspray. The static field is provided by a grid, into which a high voltage, low amperage direct current is fed.

As the sprayed paint particles pass through this field, they become electrically charged. The parts to be sprayed are given an opposite charge. Thus, the sprayed material is drawn to the parts in much the same manner as iron filings are drawn to a magnet.

The main advantages of electrostatic spraying include not only greater uniformity of the sprayed coat, but also very low overspray. Loss of coating material is substantially reduced and the spray booth exhaust system can be less elaborate. In addition, electrostatic spraying gives a high degree of "wrap-around"—paint is drawn to surfaces that are not in the direct line of fire.

In the more up-to-date approach to electrostatic spraying, the static field is eliminated and the current is applied directly to the nozzle of the gun (which is ungrounded). Thus, the paint particles pick up their static charge as they leave the nozzle.

Still another approach substitutes a rotating disc for the spray gun. Coating material that is flowed onto this electrically charged disc is propelled by centrifugal force toward the work; magnetic attraction between paint and part takes over from there. (This is the system employed in the case history on page 96.) The obvious advantage of this approach is the elimination of spray guns, air compressors, air lines and the like.

Hot Spraying; Steam Spraying

Another method that eliminates compressed air is hot spraying. The enamel or lacquer is first heated, then forced under pressure through a special spray device. When the hot material enters the atmosphere, the heat of vaporization breaks it up into small particles that are deposited on the workpiece.

This not only eliminates the compressed air system, but also requires a less elaborate exhaust system than is necessary with a conventional air spray. What's more, heating of the enamel reduces the amount of solvent required.

A fairly recent development substitutes superheated steam for compressed air. The steam both atomizes the enamel and propels it at the workpiece. This process is said to give better coating of irregularly shaped parts with inaccessible recesses. It is also less prone t overspray and permits the use of l solvent than is the case with compress air spraying.

Sometimes It's Rolled On . . .

Sometimes the fastest and cheap way to apply an organic coating aluminum is to roll it on. This is esp cially true when large flat sheets coiled stock is to be coated.

Most of the aluminum that is coat by this method is processed in lar built-to-order, automatic installatio that take in coiled stock at one end, a clean, conversion coat, rinse, dry, pa and bake it in a continuous operati Special roller setups are often incor rated to coat the stock on both sides, the same or different colors.

Most installations of this type operated by firms that produce preco ed aluminum stock for the trade. In recent survey of ten of these firms, M ern Metals found that all but one e ploy roller coating.

Nearly all of these firms reported t they supply precoated aluminum st in virtually any color. The selection widths reported range all the way fr one to 12 inches to a maximum of inches. Other installations are known produce precoated stock up to five f wide.

Most of the firms surveyed said t their precoated stock is used in av ings, siding, and other building pr ucts. A few reported other applicati such as ceiling tile, screen frames, bo caps, toys, automotive trim, tubi moldings, dials, nameplates, and ot products.

Precoated coil is usually coated w flexible, tightly adherent enamels t will withstand fabricating operati such as cutting, bending, perforati punching, stamping, roll forming, a the like without cracking, peeling, flaking off.

. . . or Flowed or Dipped

One of the firms surveyed said t it produces precoated stock by the fl coating process. As the name impl this method applies enamel or ot coatings to the workpiece (usually sheets) by simply flowing it on from or more nozzles. It is not a precis process, and usually applies a heav coating than is needed in most appl tions.

Dip painting also applies a thic coating than is usually needed, a may require more floor space than ot methods. On the other hand, it requi a minimum of skill, and may prove id for painting a product with deep c cesses that would be inaccessible to spray gun. Dipping requires a s stantial exhaust system, some means

Photographed at Fenestra Inc., Philadelphia

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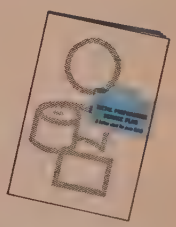

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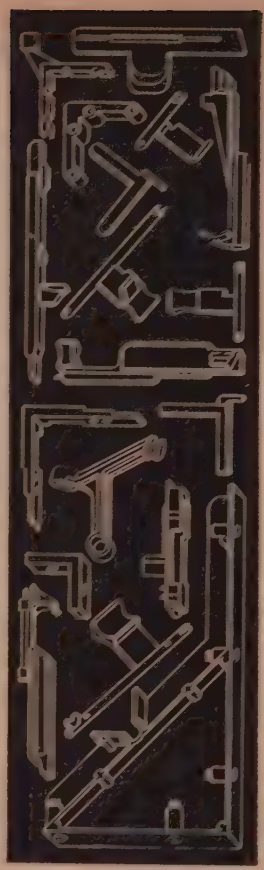

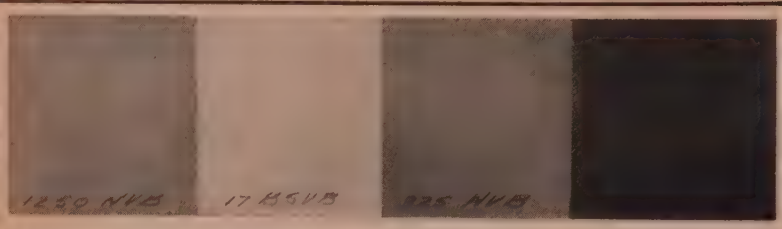

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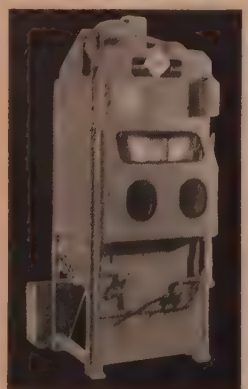

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removing foreign matter from the ta
some means of agitating the paint, a
well-organized safety precautions.

To Bake It or Dry It . . .

Coatings that are based on therm
setting resins must be bake-dried. A
even when air-drying enamels or
quers are used, it may be advantage
to force-dry them under heat. T
speeds production and often impro
the mechanical properties of the coati

Baking or drying is done in eit
batch-type ovens or continuous ov
fitted with conveyors. The former
generally used when production
quirements are relatively low. For hi
volume work, the continuous oven
the more efficient. Heating may
either the convection type in which
air does the work, or radiant heati

In either case, thorough venting
necessary. The heating process rele
volatile solvent fumes which could p
a serious explosion hazard if allowed
accumulate.

The size of the exhaust system
pends on many factors – volume
work, quantity of solvent used, etc
but it's better to err on the gener
side. Many baking ovens incorpor
multiple zone control, with vary
temperatures for solvent release, cur
and cooling. Circulating fans are u
to distribute heat uniformly over
work.

Infra-Red Getting Hot

Radiant heating is rapidly gain
favor for installations where large
umes of work are to be baked or dri
The radiant oven does not requir
heavily insulated construction, and h
loss is no problem since the heat
directed in a straight line from
source to the work.

The heat source may be either e
trical resistance elements or banks
infra-red lamps (see case history
page 98). Some ovens have gas-he
systems in which heat is radiated to
work by ceramic elements that
heated by gas burners.

Radiant heating is especially g
for large flat or smooth surfaces
are readily accessible to straight-
infra-red radiations. If deep rece
undercuts, and the like are invol
radiant heating may prove unsa
factory.

A white or light colored enamel
tend to reflect some of the heat,
slowing the curing or drying pro
By the same token, dark colors
dry or cure faster. Obviously, it is
portant to establish the optimum cu
or drying time for a given applica
and adjust heat input, conveyor s
and other variables accordingly.

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SCHLOEMANN

Growing rolling mills

It is not always possible to plan complete new rolling mill installations for maximum output. From the point of view of economy it is often necessary to modernize existing plants and enlarge them or to construct new plants in stages, so as to adapt oneself to available means or to meet later the demands of a slowly growing market. Much experience is required to find a solution to problems arising in this connection and to ensure a high degree of economy until the entire plant has been built. SCHLOEMANN is at present building four rolling mill plants for steel and non-ferrous metals, which provide for construction in stages. An example is given in the following:

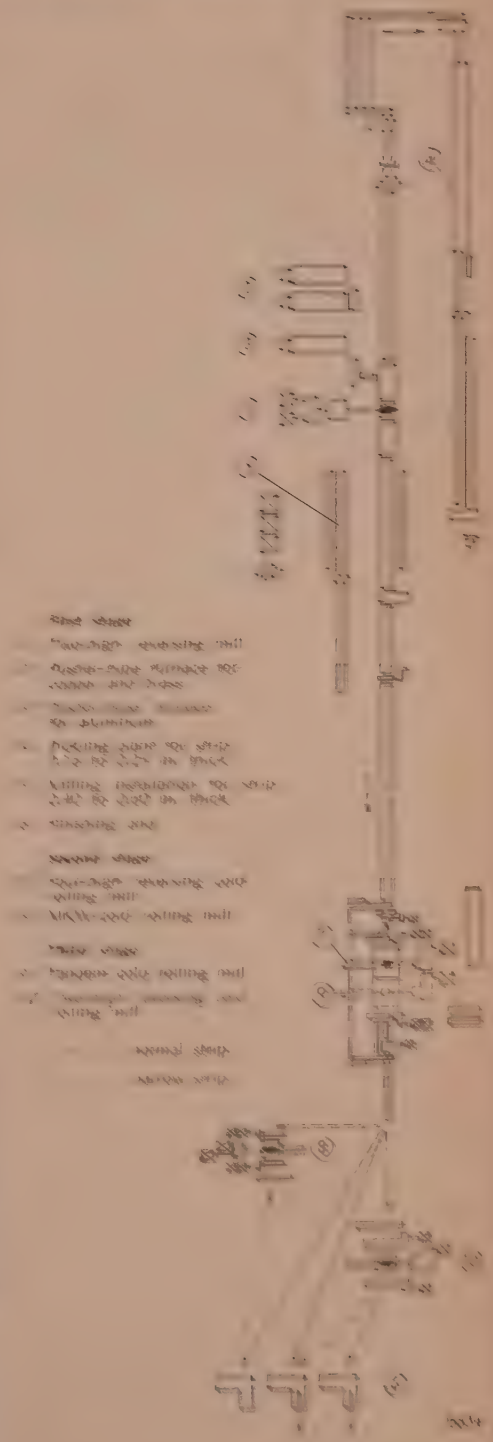
Stage 1: A two-high reversing mill for hot and cold rolling of non-ferrous and light metals.

Stage 2: The existing two-high reversing mill is now used only for hot rolling, so a four-high reversing mill is added for intermediate cold rolling and a MKW-type cold rolling mill for finishing of light gauge strip and temper rolling of all strip.

Stage 3: The extension of the four-high reversing mill into a tandem mill and the addition of a two-high cold rolling mill for temper rolling.

Stage 4: The hot rolling mill and cold rolling mills are used only for the rolling of copper and brass and a separate mill is put up for the rolling of aluminium.

On this two-high reversing mill slabs of copper, aluminium and their alloys are rolled into strip in the first stage of construction. The mill serves for both hot and cold rolling.



Layout of a hot and cold rolling mill being erected in several stages

FELLER ENGINEERING CO., 1165 EMPIRE BUILDING, PITTSBURGH 22, PA.

What's Happening in

PORCELAIN ENAMELING ALUMINUM

design considerations — pretreatmen frits — enameling practice — color appl cations — new developments

THE ART of porcelain enameling metal is thousands of years old, but its application to aluminum has been practiced commercially only during the past 15 years or so. In spite of this brief career, aluminum has had its own broad technological development as an enameling base, and the list of consumer products is growing rapidly. Building and construction and the appliance fields are the heavy users of porcelain enameled wrought aluminum products and provide excellent examples.

The use of porcelain enamel on aluminum has doubled every year for the past three or four years. This isn't hard to credit when one considers the many favorable properties of the various ceramic coatings combined with aluminum. Such coatings have a reflectivity ranging from very dull matt to extremely high gloss in the broadest range of light-fast colors. What's more, these finishes are very durable, being highly resistant to impact with no progressive spalling from surface damage. Porcelain enamel finishes are very hard — many times harder than organic coatings.

Vitreous coatings for aluminum have strong resistance to acids, alkalies and sulfides. Though not comparable to those coatings used on steel, their chemical resistance is vastly superior to any other commercial finish for aluminum. As a measure of the material's resistance to thermal shock, enameled panels have been heated to 1000° F., then plunged into cold water with no cracking or flaking of the coating. Twenty percent salt spray tests of 480 hours' duration showed no deterioration.

Because of the added rigidity given to aluminum by porcelain enameling, the material is often employed to save weight while actually gaining strength for the part. A thinner section of bare aluminum actually takes on considerably more strength and rigidity than some heavier sections by virtue of the porcelain enamel coating.

The material stands up well under fabrication, too. Such operations as cutting with hack saw, band saw, power circular saw and mechanical shear, and drilling or punching cause no chipping or progressive spalling.

Neither normal cooking temperatures nor open flame will affect the color or finish. In fact, enameled aluminum of any thickness, ranging from very thin to heavy, can be welded on the reverse side without discoloration or damage to the coated surface.

Porcelain enameled aluminum has good dielectric properties, having a voltage breakdown rating of 500 volts per mil thickness.

Porcelain enameled aluminum has the advantage over porcelain enameled steel in fabrication and shipping and handling costs, as well as in chip and rust resistance. Aluminum's workability on the job, the fact that sheared edges don't corrode, plus a weight reduction of as much as two-thirds, would give the preference to aluminum.

The Porcelain Enamel Institute lists certain design considerations:

There is a proper gauge of metal for a particular enameling application to avoid such faults as warping, sagging and hairlining. Selection of a light gauge of aluminum in order to keep costs down is likely to increase the final cost of the job.

Embossed or coined sheet has its liabilities. Burrs should be removed before enameling. Sharp radii must be avoided; the minimum radius should be 1/16-inch.

Drawn parts with large flat areas are subject to warping caused by unequal stresses which have been created during forming, and relieving of these stresses during subsequent firing. Therefore, parts requiring deep draws usually require a non-heat treatable alloy in the fully annealed temper.

Non-heat treatable alloys may have lower mechanical properties but may still be used for a variety of applications if designs incorporating special back-up details, reinforcing ribs and heavier gauges are considered.

The materials applied to the aluminum in the porcelain enameling process are vitreous compounds (called frits) which are ground to fine granular particles in special mills and, with the addition of water and other compounds, turned into a liquid called a slip.

The slip is applied to the metal b dipping, spraying and other metho after which it is baked (or fired) high temperature to produce the sol porcelain enameled coating. There a wide variety of frits designed f various alloys and service conditio Pigments are added to the slip f colored coatings.

The original operating sequence the porcelain enameling of aluminu was as follows: Cleaning, surface co ditioning, prefiring, applying groun coat, firing, applying cover coat, fin firing. While this sequence may st be followed, technological advances ha enabled most enamelers to eliminate t prefiring step. In many plants t groundcoat and groundcoat firing ste have been eliminated too. Howev where prefiring is no longer done, t need is heightened for taking the gre est pains in the cleaning and surfa conditioning steps.

Aluminum surfaces to be porcela enameled must first be thorough cleaned in order to rid the aluminu of all foreign matter. Inadequate clea ing assures failure of the coating ope tion. There are several proprieta cleaners for aluminum which may classed as non-inhibited, inhibited, a emulsion types. A non-inhibited, et type cleaner is recommended because the ease of rinsing, the ease with whi the bath can be controlled, and ability to take off film which mig dry on the metal after it comes out the bath.

In the cases of aluminum alloys 11 and 3003, the only surface preparat treatment necessary is to clean off gre or oil films by vapor degreasing or t use of mild alkaline cleaners prior enameling. To achieve spalling res ance, an oxide layer should be bu up on the surface of the aluminum; t alloys mentioned already have a s ficient layer, assuring adequate bondi without further treatment.

Objective of the surface conditioni process is to achieve a uniform surfa to receive the porcelain enamel co ing. Etching of certain alloys is oft desirable before applying the chrom conversion coating. A deoxidizing

smutting dip might also be necessary. Final conditioning step is the chro-ate conversion bath just mentioned. here are several formulas that can be ed, as well as the many proprietary mpounds listed elsewhere in this ue.

While these treatments are required all other aluminum alloys except 00, 3003 and Alclad 6061, processes ve been developed which make the efiring step unnecessary.

E. I. DuPont de Nemours & Co. has oneered in aluminum surface condi-oning processes for porcelain enamel-g, assisted by Ferro Corp., Cleveland, d Pemco Corp., Baltimore, manu-cturers of frits. A modification of an iginal DuPont process eliminates the efiring step.

odified DuPont:

1. A 2-4 minute immersion in acid rome bath at 180° F.
2. Water rinse.
3. A ¼ to ½-minute immersion in an kaline chrome bath at room tempera-re (potassium chromate, 17-21% by ight; sodium hydroxide, 3.5-4.1% by ight).
4. Water rinse and drain dry.
5. Spray enamel.
6. Fire.

Steps 5 and 6 can be repeated if addi-onal coatings are desired.

A surface conditioning process devel-ed by Aluminum Co. of America can used for all alloys whether cast or ought. The Alcoa R-100 etching proc-will remove to some extent grease, bricants, oxide films, heat treatment ms and render the aluminum surface ceptive for either the ground or top at. If the work has a heavy grease m or fabricating lubricants, vapor de-easing or emulsion cleaning is recom-ended so as not to contaminate the 100 bath. This bath consists of com-ercial acids but is a patented process of coa's.

These days, the great majority of ameling operations require only three sic steps — cleaning, pretreatment d enameling. Usually only one coat enamel is needed. The use of the 100 pretreatment process is reported be widely used to expedite the middle p.

Some highly effective proprietary pre-ameling formulations are made by nchem Products, Inc., Parker Rust oof Co., and others.

The purpose of prefiring is to "fix" oxide film which has been created the pretreatment step. The same ng conditions apply as for ground-at firing. After prefiring the stock ed not be enameled immediately but y be held for a reasonable length of

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CASE HISTORY: Porcelain Enameled Store Fronts

One of the earliest practitioners of porcelain enameling on aluminum was Kawneer Co., Niles, Mich., who for the past 11 years have been porcelain enameling their store front product, "Zourite," roll formed to shape in 16-foot lengths in two standard widths (application pictured above). Kawneer has operated through all the vicissitudes of PEA practice during which the company has advanced from a manual 3-coat system to an automatic, 1-coat operation today, except where white and yellow coatings call for two spray applications for optimum hiding power. Total thickness of the coating has ben reduced from 6-8 mils to 2-4 mils, imparting greater flexibility with no reduction in coating quality. Pretreatment operation today is the modified DuPont process, with prefiring done only long enough to thoroughly dry the surface and burn off leftover impurities.

time if convenient. But the work must be protected from any kind of soil or other contaminant. Other than simple straightening, no attempt should be made to form the work between prefiring and enameling.

Groundcoat should not be applied until the work has cooled to room temperature from prefiring. Its main purpose is to serve as a bond for the cover coat.

Composition of the ground coat depends on the alloy on which it is applied, and the requirements of color and cover characteristics of the cover coat. Standard clear groundcoats are preferred except when a white or pastel cover coat is used; however, satisfactory results are obtained with a colored cover coat over a white groundcoat.

Unless otherwise specified in the frit specs, the fully charged groundcoat frit should be ground until no more than 0.2 gram from a 50-ml. sample is retained on a 325 mesh screen.

While roller coating and dipping have been successfully used to apply the slip to the aluminum, spraying is the most widely used process. This is because it has been found that spraying tends to hide minor surface flaws and maintain uniform thickness on the piece easier than coating by other methods. Irregular shapes are given a better coat by spraying.

Spraying Tips

Hand and automatic spray guns are being used successfully today. There are two basic types of automatic spray machines — the reciprocating and the spindle type. The former is used for spraying work lying flat or hanging; the spindle type is for spraying objects that can be rotated while being sprayed. One of the advantages of the automatic spray gun is the uniform spraying given to the individual work part, as well as coating uniformity from part to part.

A close check should be kept on the viscosity of the milled slip. Optimum specific gravity of the slip should be 1.9. Proper spray weight can be determined by weighing the piece before and after coating; from 15 to 20 grams per square foot wet should be deposited.

Sprayed work must not be left over night before firing. Drying is continued only until all surface moisture disappears. No special equipment is needed for drying other than adequate protection from falling dust and dirt.

After drying, the work is supported on suitable firing hangers and is fired at a temperature of 970° to 1000° F. Small charges of thin section require a minimum of 5 minutes. In production furnaces, firing conditions depend upon the load, thickness of sections, location of thermocouples, and other factors.

Essentially, the load must be brought completely up to temperature and held there for 4 to 4½ minutes. If the temperature exceeds the specified limit there may be excessive metal deformation. Too low a temperature and/or too short a firing time result in a poor bond between groundcoat and metal. Refiring at a higher temperature for a longer time usually corrects underfiring. A poor bond may also be attributable to over-treatment of the aluminum before enameling.

When the fired groundcoat has cooled to room temperature, the cover coat can be sprayed on, taking the usual interim safeguards against grease and other soil. The cover coat may be sprayed on at the required thickness or it can be brought up to finished thickness by two coating stages and intermediate firings. With non-rigid sections enamel both sides of the work to avoid warping. Sheet stock enameled on only one side will warp because of the difference in coefficient of expansion between the metal and the vitreous film. This can be done economically by using scrap or reclaimed enamel to coat the reverse side.

Cover coats are usually fired in the same manner as groundcoats. Overfiring could result in failure in the accelerated spalling test. Thickness of the cover coat and firing conditions can, to some degree, affect final color.

The accelerated spalling test is a quality control technique that may always be used. It's the best and quickest method of gauging ability of enamel to adhere to the aluminum under weathering conditions.

In the test, work samples are immersed in 5% ammonium chloride solution at room temperature. A minimum of six inches of interface between enamel and aluminum on each piece must be exposed. It may be necessary to file the edges to expose the interface. The test pieces are examined after 24 hours and again after 96 hours. Effects of the bath are generally very extensive or negligible, eliminating the need for accurate measurement; however, if enamel loss progresses over ⅛ inch in from the filed edge and more than ½ inch along the edge, the job is considered a failure.

Test pieces are selected at rand-

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Extending the range and application of light alloy extrusions is one of the important services PMD has contributed to the light metals industry. Through the development of advanced tooling techniques, PMD has helped pioneer imaginative new concepts of product design—concepts which point the way to new cost savings by reducing or eliminating such production operations as assembling, fastening, joining, etc.

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from each job lot. Immediate test should be made of any production run where materials, stock, operating conditions or procedures have been changed.

Where it is not practical to take a sample from the actual job, a sample strip of the same stock, 2 x 6 inches, or any convenient size, may be substituted. These sample strips should accompany each load of work through the metal preparation, coating and firing, and should be identified with each load. This system has the advantage of providing a test specimen which can be filed for future reference.

While porcelain enameling on both sides of the work almost invariably prevents warping, sometimes it isn't practical to do this. Where one-side coated sheet work has warped, it can be straightened by rolls or presses. Rolls made of steel, rubber and wood have been used successfully.

Rejected or spoiled stock can be reclaimed by immersing the work in a 20% nitric acid bath (1 part concentrated HNO_3, 4 parts water). This treatment will take off the enameling without attacking the oxide conversion coating. However, practice is to remove the pretreatment film anyway, using a 10% cold caustic soda dip, and leaving the work in the tank just long enough to take off the oxide film. After this the work can be rinsed, acid cleaned and given another pre-enameling treatment.

Small tears in the enamel can be repaired on alloys 6061, 6062 and 6063; patch and then refire. Spot spraying and refiring can be done on defects in coatings by drilling out the fault.

No particular skill is needed to drill, saw, shear or stamp porcelain enameled aluminum. When welding, extreme care must be taken not to burn through the lighter gauges. There is less tendency to deform gas welded parts than electric welded ones.

New Developments

Research in the porcelain enameling of aluminum is proceeding, and producing results in many areas. In fact, the Modern Metals' survey on aluminum finishing indicates such rapid growth that it is difficult to keep pace with developments.

However, facts gleaned from manufacturers of frit and porcelain enameled aluminum, as well as the primary aluminum producers, go far in explaining why the industry has been able to accomplish a 500% increase in porcelain enameled aluminum production in three years instead of five, as predicted by an industry authority in 1956.

Ferro Corp., Cleveland, reports the introduction of several new frits, with others in various stages of development.

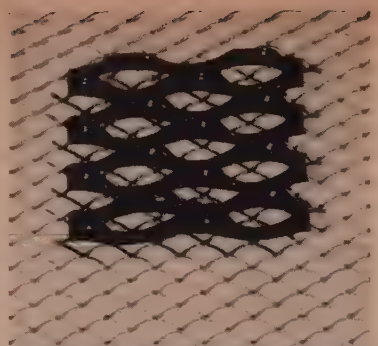
"One noteworthy type is a lead-free, cadmium-base frit which serves as a good general purpose base for all colors, as well as offering a leadless frit," a Ferro spokesman said. "In another area, work is proceeding on an enamel which will go far in helping to reduce deformation currently being experienced by aluminum enamelers."

Ferro is also making progress in its effort to reduce firing temperatures of the enamels, and improving the physical and chemical resistance of frits.

In addition to frit improvement, Ferro reports progress on improved mill formulas for slip preparation. In this area a new mill addition has been introduced which allows the enameler some flexibility in the adjustment of his slip after grinding, as well as providing better ageing properties and making possible higher gloss enamels.

"Another area in which great strides have been made to improve aluminum enamels is color oxides," Ferro reports. "Due to the greatly increased demand for these materials, it has been possible to introduce a complete set of color oxides which are specifically controlled for use in aluminum enamels."

As already mentioned, pretreatment methods have been advanced to the point where the prefire can be eliminated from the recommended cycle for preparation of 6061 alloy.



CASE HISTORY: Porcelain on Expanded Metal

Porcelain enameled expanded metal sheets, steel and aluminum, are being coated by Ingram-Richardson Mfg. Co., Beaver Falls, Pa. The method involves use of special enamels and new processing procedures for durability and uniform coverage. Ing-Rich can coat the material in any one of many patterns supplied by leading manufacturers. The products are finding many uses in the architectural field.

The growth of porcelain enameli on aluminum has stimulated develo ment of special alloys. Alcoa is n making two types of porcelain enam ing aluminum sheet—one heat treatab the other non-heat treatable—and an loy for porcelain enameled extrud shapes. They are said to give uniform of behavior throughout the process, a require less critical control.

Porcelain Enameled Castings

An outstanding achievement in por lain enameling aluminum was extensi of the process to include alumin permanent mold castings. One proc now called "Porceglaze," is exclus with Monarch Aluminum Mfg. C Cleveland 2, a diecaster and perman mold foundry.

After 15 months of research, Mona licked all the problems that h stumped the aluminum enamelers, veloped new operating equipment a production methods and are now p ducing enameled castings for many ferent types of end product manufact ers on a big volume basis.

Monarch methods are applied to exposed surface of the casting. T company points out that where h conductivity is an important funct of the product, casting areas receiv or transmitting the heat should not enameled; nor do the low-temperat lead bearing frits allow enameled faces to be used in contact with fo

"Exposed irregular surfaces, v thicknesses, radii, bosses or other cr section factors common to commer castings can normally be enameled w out undue trouble, maintaining a form coating of porcelain enam Monarch says. "The coating can applied directly over normal as-cast faces and achieve a pleasing appearan

"Preliminary finishing operations be added if desired to obtain a smoot gloss finish. This becomes simply matter of final cost analysis. Many our other finishing techniques can combined with the enamel to add tinction to the product."

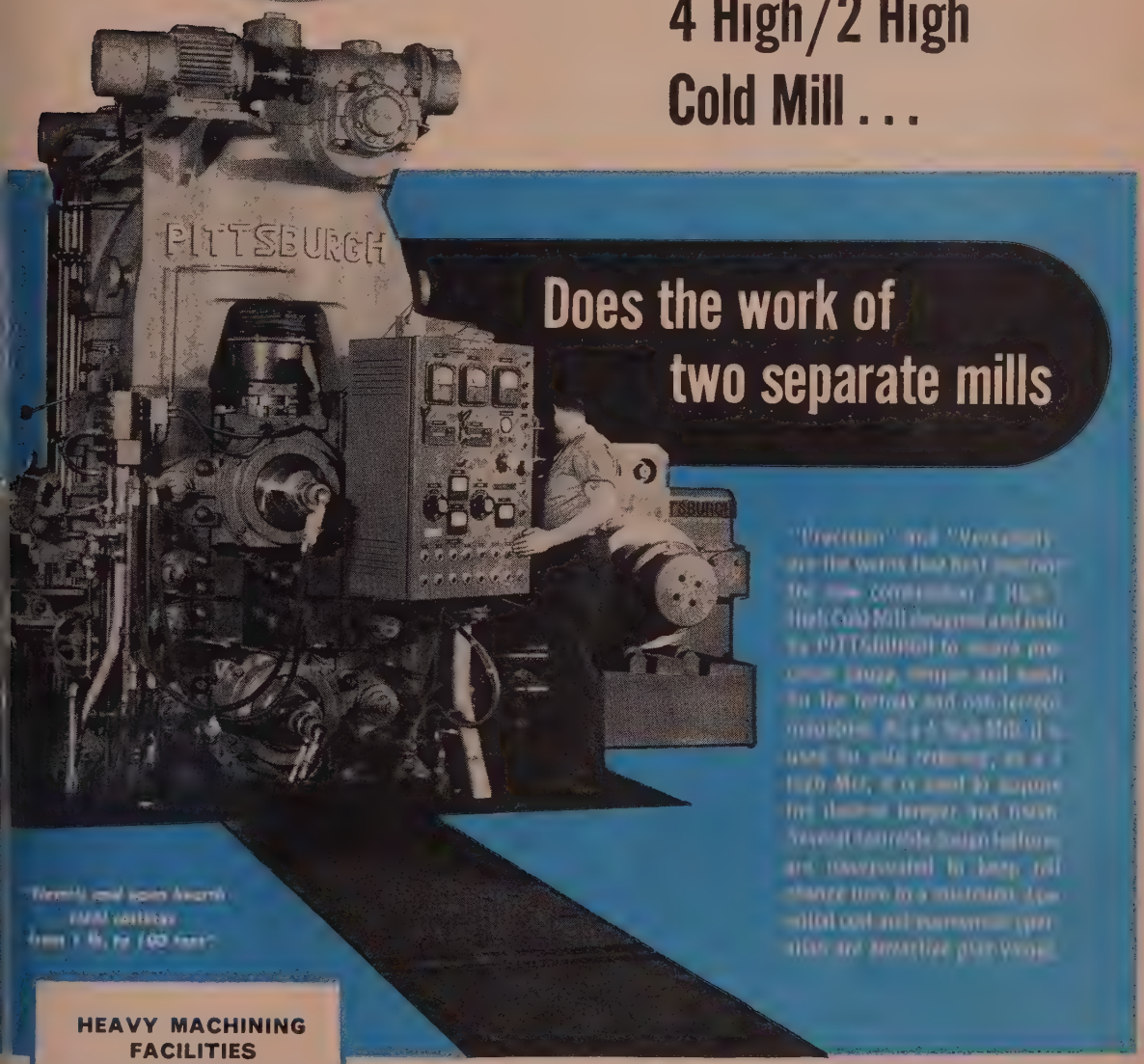
Monarch believes that porcelain ameled aluminum castings can be s sequently machined or finished in customer's plant without notice damage if proper care is exercised.

Monarch's "Porceglaze" process thus add the advantage of color appe where desirable, to certain types consumer products, besides impar surface protection, insulation or pregnation to these and other type products or components.

The California Metal Enameling Los Angeles 22, reports that it has

PITTSBURGH

Combination 4 High/2 High Cold Mill . . .



Does the work of two separate mills

"Tractium" and "Versamill" are the names that best describe the new combination 4 High/2 High Cold Mill designed and built by PITTSburgh to assure precision gauge, temper and finish for the ferrous and non-ferrous industries. As a 4 High Mill it is used for cold reducing, as a 2 High Mill, it is used to improve the surface temper and finish. Several automatic design features are incorporated to keep roll change time to a minimum. Low initial cost and maximum operation are amortize quickly.

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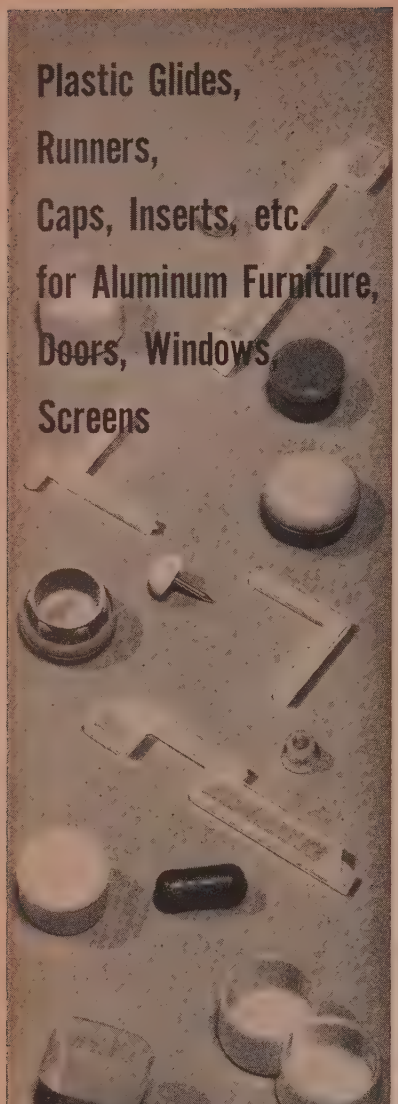

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porcelain enameling aluminum permanent mold castings for two years.

"Color provides a great public service by helping to quickly identify fire warning and public emergency alarm boxes," said H. V. Penton, vice president of this company. "Maintaining an impermanent paint finish on such equipment is costly; faded colors lessen their safety function."

Penton said that the Phonalarm Division of Angelus Industries, North Hollywood, Calif., makers of the systems, uses permanent mold cast aluminum boxes for lighter weight and greater strength.

California Metal Enameling Co. applies a 2 to 3 mil coating in three background colors – red, yellow and white, depending on the usage. Alloys used may be either 4043 or 356, Penton said.

Applications

The ability to porcelain enamel castings (Monarch is researching a process for die castings) has greatly expanded an already long list of product applications.

To porcelain enameled products like store front panels; door and window frames; outdoor furniture; all types of signs and labels; tile and panels for bathrooms and kitchens; siding for all types of buildings; tanks and containers; electrical shielding: pipes and fittings; aircraft and functional parts; railway car interiors; lighting fixtures; sanitary ware; and decorative displays can be added:

Permanent mold cast housings for lawn mowers; street light domes; housings for electrical controls used in corrosive atmospheres; automatic washer agitators, handles for keyhole and other types of saws; fire extinguisher parts; sole plates for electric steam irons; waffle makers and many other appliances for home and commercial use.

Ferro Corp., who with E. I. DuPont deNemours & Co., supply enameling frits to Monarch, reports the use of enameled aluminum in the form of covers for hearing aids which are built into eyeglass frames.

"Another example of the durability and protective properties of aluminum enamels is their use on cast aluminum telephone boxes which are placed along ocean front beaches to withstand the heavily salt-laden atmospheres," Ferro said.

Gulton Industries, Inc., Metuchen, N. J., reported on the early stages of its research program being conducted jointly with Lithium Corp. of America on the application of ceramic coatings to structural aluminum alloys used in aircraft and missiles.

New ceramic coatings developed by Gulton Industries impart outstanding refractory and insulating properties, enabling these alloys to withstand pr longed heat at 1300 to 1350° F. witho collapsing, the company announced.

Tests were performed on .040 in thick aluminum sheet with a .0015 in ceramic coating. The sample was su jected to a flame impingement test f 120 minutes at a flame temperature 2200° F. without damage. The temper ture at the coated surface was measur at 1700 to 1800° F. The same fla burned a hole in an uncoated aluminu sample of the same type and thickn in about 30 seconds.

Gulton pointed out that structu aluminum alloys in sheets, coated both sides, will still be one-third t weight of comparable steel sheets a relatively lighter than other super all and still retain their strength for u as aircraft skins at the supersonic ran of 1300 to 1700° F.

New aluminum alloys are now in t process of development that are sa will retain their tensile strength at hig er temperature ranges suitable for l personic equipment.

"Ceramic coatings for these new all may result in achieving our goal maintaining high tensile strength elevated temperatures," Gulton said.

The new coatings may be appli before final heat treating of the allo thus combining heat treating and firi of the coating into a single operatio

Expanded Metal, Too

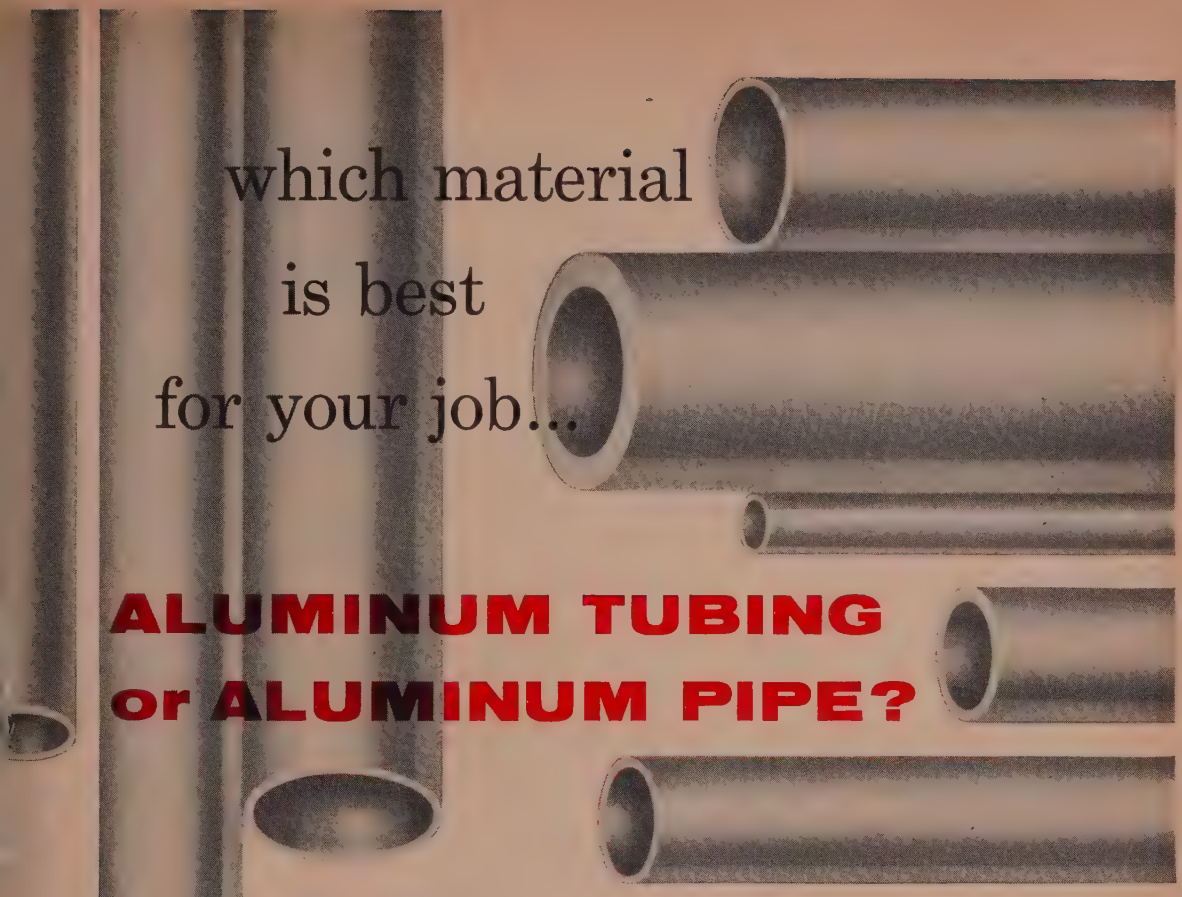
Ingram-Richardson Mfg. Co., Beav Falls, Pa., has developed a method porcelain enameling expanded me sheets for architectural applications.

Used for either expanded steel aluminum, the method involves the u of special enamels and new processi procedures which assure uniform cov age and durability. A wide range enameled colors are optional.

Expanded metal sheets are norma supplied in 3 x 8 foot or 4 x 8 f sizes and Ingram-Richardson can por lain enamel them in any one of ma patterns offered by leading manuf turers of the expanded sheets. They being used as protective or decorat grilles, ventilator covers, sunshades other types of partitioning, backgrou for sign spectaculars, and other ty of decorative panels.

The O. Hommel Co., Pittsburgh, l recently developed Liquid No. 530 special ceramic coating for use on a material that has to be heated. It particularly suited to heat resistant p tics, titanium, stainless and nickel pla steels, Hommel reports.

"It is of great value in reducing te peratures where radiation is involv and has the advantage of low cur temperature (500° F.)" the comp said.



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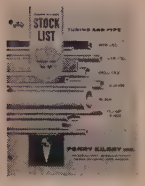

Ask for free Perry Kilsby Stock List—issued quarterly, it keeps you posted on new sizes of all tubing materials carried in stock!

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Conversion Chemical Corp.
Rockville, Conn.
Grav-i-Flo Corp.
Sturgis, Mich.
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Matawan, N. J.
Heatbath Corp.
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Waterbury 20, Conn.
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Parker Rust Proof Co.
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uis 16, Mo.
DeVilbiss Co.
o 1, Ohio
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Haven 11, Conn.
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Houghton Co.
delphia 33, Pa.
Lea Mfg. Co.
rbury 20, Conn.
F. L'Hommedieu & Sons Co.
go 23, Ill.
on Process, Inc.
Island 1, N. Y.
Plating Equipment Co.
klyn 11, N. Y.
Plating Products Co., Inc.
rk 2, N. J.
Solvay Process Div.
Chemical Corp.
York 6, N. Y.
ers Bros. Mfg. Co.
uis 7, Mo.
ric B. Stevens Inc.
it 16, Mich.
Uddylite Corp.
it 11, Mich.
Galvanizing & Plating
uipment Corp.
klyn 11, N. Y.
rtical Foundry & Machine Co.
it 27, Mich.

DRIERS (Centrifugal)

-Knodel Co.
York 12, N. Y.
Mfg. Co.
go 51, Ill.
Butcher Co.
ngeles 26, Calif.
n Rheostat & Supply Co.
rove Village, Ill.
on-Van Winkle-Munning Co.
wan, N. J.
Lea Manufacturing Co.
rbury 20, Conn.
es F. L'Hommedieu & Sons Co.
go 23, Ill.

ELECTROPLATING AND ANODIZING EQUIPMENT

y Process Automation Inc.
Island City 1, N.Y.
n Rheostat & Supply Co.
Grove Village, Ill.
ral Electric Co.
nburg, Va.
on-Van Winkle-Munning Co.
wan, N. J.
Process Equipment Corp.
land 11, O.
lland & Sons Inc.
klyn 11, N.Y.
Finishing Equipment Corp.
York 10, N. Y.
Lea Manufacturing Co.
rbury 20, Conn.
Meaker Co.
go 50, Ill.
ric B. Stevens, Inc.
it 16, Mich.
Gilbert Tramer Co.
land 13, O.
Uddylite Corp.
it 11, Mich.
Walgren Co.
Rapids 3, Mich.

ANTS FOR ALUMINUM

mize Corp.
go 24, Ill.
Research Products, Inc.
more 5, Md.
em Products, Inc.
er, Pa.
sey Corp.
go 13, Ill.
ne Inc.
Haven, Conn.
rick Gumm Chemical Corp.
y, N. J.
ermid, Inc.
rbury 20, Conn.
e Products, Inc.
York 6, N. Y.
alt Chemicals Corp.
lelphia 2, Pa.
dotte Chemical Corp.
dotte, Mich.

ORGANIC COATINGS

Paint & Varnish Co.
, Ohio
an Chemical Products, Inc.
York 16, N. Y.
gyptian Lacquer Mfg. Co.
rk 1, N. J.
n Co.
and 2, Ohio
es Powder Co.
ise Products Dept.
ington 99, Del.
ohnson & Son, Inc.
, Wis.
& Thermit Corp.
y, N. J.

Pyroxylin Products, Inc.
Chicago 32, Ill.

OVENS, Baking, Drying

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Belke Manufacturing Co.
Chicago 51, Ill.
Cleveland Process Corp.
Cleveland 3, Ohio
DriQuick Division
Dry Clime Corp.
Greensburg, Ind.
J. Holland & Sons, Inc.
Brooklyn 11, N. Y.
The Lea Manufacturing Co.
Waterbury 20, Conn.
Pennsalt Chemicals Corp.
Philadelphia 2, Pa.
Pyrosil, Inc.
Cuyohoga Falls, O.
Frederic B. Stevens. Inc.
Detroit 16, Mich.
G. H. Walgren Co.
Grand Rapids 3, Mich.

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Binks Mfg. Co.
Chicago 12, Ill.
Cincinnati Cleaning & Finishing Co.
Cincinnati 41, Ohio
Conforming Matrix Co.
Toledo 2, Ohio
The DeVilbiss Co.
Toledo 1, Ohio
Egyptian Lacquer Mfg. Co.
Newark 1, N. J.
Gasway Corp.
Chicago 26, Ill.
J. Holland & Sons, Inc.
Brooklyn 11, N. Y.
Ionic Electrostatic Corp.
Garfield, N. J.
Metalwash Machinery Corp.
Elizabeth 4, N. J.
Murray Way Corp.
Birmingham, Mich.
Nordson Corp.
Amherst, Ohio
Pennsalt Chemicals Corp.
Philadelphia 2, Pa.
Ransburg Electro-Coating Corp.
Indianapolis, Ind.
Spee-Flo Co.
Houston 11, Texas
Worthy Products Co.
Temple, Pa.

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American Buff Co.
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Beam-Knodel Co.
New York 12, N.Y.
Belke Mfg. Co.
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Clair Mfg. Co., Inc.
Olean, N.Y.
Hammond Machinery Builders, Inc.
Kalamazoo 54. Mich.
Hanson-Van Winkle-Munning Co.
Matawan, N.J.
The Lea Mfg. Co.
Waterbury 20. Conn.
Charles F. L.'Hommedieu & Sons Co.
Chicago 23, Ill.
Lindale Equipment & Supply Corp.
Brooklyn 31, N. Y.
Munning & Munning, Inc.
Newark 5, N. J.
Murray Way Corp.
Birmingham, Mich.
Sommers Bros. Mfg. Co.
St. Louis 7, Mo.
Frederic B. Stevens, Inc.
Detroit 16, Mich.
The Stutz, Co.
Chicago 24, Ill.
G. H. Walgren Co.
Grand Rapids 3, Mich.

PORCELAIN ENAMELERS OF ALUMINUM

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Middletown, Conn.
California Metal Enameling Co.
Los Angeles, Calif.
Chronoflash Co.
Oakdale, Pa.
Donwell Corp.
Manchester. Conn.
Enamel Products Co.
Cleveland 8, Ohio
Foster-Jacob, Inc.
Peoria, Ill.
Halrick, Inc.
Danbury, Conn.
Hamlin-Stevens, Inc.
Fairfield, Conn.
Ingram-Richardson Mfg. Co.
Beaver Falls, Pa.
Kawneer Co.
Niles, Mich.

Keasbey Corp.
Keasbey, N. J.
Monarch Aluminum Mfg. Co.
Cleveland 2, Ohio
Porce-Alume Co.
ConnerSville, Ind.
Porcelain Steel Corp.
Connersville, Ind.
Porce-Len, Inc.
Hamden, Conn.
Seaporcel Metals, Inc.
Long Island City, N.Y.

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Bridgeport Brass Co.
Bridgeport 2, Conn.
Clad-Rex Corp.
Chicago 16, Ill.
Coated Materials Co.
Pittsburgh 23, Pa.
Coil Anodizers Inc.
Muskegon, Mich.
Colored Metals, Inc.
Tampa, Florida
Hastings Aluminum Co.
Hastings, Mich.
Hi-Ten Metal Products, Corp.
Mattison, Ill.
Lando Products, Inc.
Sausalito, Calif.
Litho-Strip Corp.
Chicago 32, Ill.
Panelfab Products, Inc.
North Miami, Fla.
Pre Finish Metals Inc.
Elk Grove, Illinois
Seaman-Andwall
Ixonia, Wis.

PRIMERS

John L. Armitage Co.
Newark 5, N. J.
Belke Mfg. Co.
Chicago 51, Ill.
The Clinton Co.
Chicago 22, Ill.
The Egyptian Lacquer Mfg. Co.
Newark 1, N. J.
The Lea Mfg. Co.
Waterbury 20, Conn.
The Lowe Bros. Co.
Dayton 2, Ohio
Metal & Thermit Corp.
Rahway, N. J.
Sommers Bros. Mfg. Co.
St. Louis 7, Mo.
Tenax Finishing Products Co.
Newark 5, N. J.

POLISHING, BUFFING COMPOUNDS

Allied Industrial Products, Inc.
Chicago 11, Ill.
Allied Research Products, Inc.
Baltimore 5, Md.
American Buff Co.
Chicago 16, Ill.
Apothecaries Hall Co.
Waterbury, Conn.
Atlantic Compound Co.
Waterbury, Conn.
Davies Supply & Mfg. Co.
St. Louis 16, Mo.
The S. A. Day Mfg. Co.
Buffalo 13, N. Y.
Formax Mfg. Co.
Detroit 7, Mich.
Frederick Gumm Chemical Co.
Kearny, N. J.
Hanson-Van Winkle-Munning Co.
Matawan, N. J.
Kraft Chemical Co.
Chicago 8, Ill.
The Lea Mfg. Co.
Waterbury 20, Mich.
Chas. F. L'Hommedieu & Sons Co.
Chicago 23, Ill.
Matchless Metal Polish Co.
Chicago 9, Ill.
Michigan Buff Co.
Detroit 12, Mich.
The Plating Products Co., Inc.
Newark 2, N. J.
Sommers Bros. Mfg. Co.
St. Louis 7, Mo.

ROLLER COATING EQUIPMENT

Gasway Corp.
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SOLVENTS, DEGREASING

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Diamond Alkali Co.
Cleveland 14, Ohio

The Dow Chemical Co.
Midland, Mich.
E. I. du Pont de Nemours & Co.
Electrochemicals Dept.
Wilmington 98, Del.
Eaton Chemical & Dyestuff Co.
Detroit 7, Mich.
Enequist Chemical Co., Inc.
Brooklyn 37, N. Y.
Enthone, Inc.
New Haven 11, Conn.
The Globe Chemical Co., Inc.
Cincinnati 17, Ohio
Frederick Gumm Chemical Co., Inc.
Kearny, N. Y.
Oakite Products, Inc.
New York 6. N. Y.
Pennsalt Chemicals Corp.
Philadelphia 2, Pa.
Solvay Process Division
Allied Chemical Corp.
New York 6, New York

STRIPPERS, METAL AND PAINT

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Belke Mfg. Co.
Chicago 51, Ill.
Bison Corp.
Canton, Ohio
The Chemical Corp.
Springfield 9, Mass.
Diamond Alkali Co.
Cleveland 14, Ohio
Diversey Corp.
Chicago 13, Ill.
Enthone, Inc.
New Haven 11, Conn.
Frederick Gumm Chemical Co., Inc.
Kearny, N. J.
Heatbath Corp.
Springfield, Mass.
Klem Chemicals, Inc.
Dearborn, Mich.
MacDermid, Inc.
Waterbury 20, Conn.
Metal & Thermit Corp.
Rahway, N. J.
Northwest Chemical Co.
Detroit 4, Mich.
Oakite Products, Inc.
New York 6, N. Y.
Pennsalt Chemicals Corp.
Philadelphia 2, Pa.
Sommers Bros. Mfg. Co.
St. Louis 7, Mo.
Standard Research, Inc.
New Haven 8, Conn.
The Stutz Co.
Chicago 24, Ill.
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Wyandotte, Mich.

STRIPPABLE COATINGS

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Electrochemicals Dept.
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Enequist Chemical Co., Inc.
Brooklyn 37, N. Y.
The Globe Chemical Co.
Cincinnati 17, Ohio
Klem Chemicals, Inc.
Dearborn, Mich.
The Lea Manufacturing Co.
Waterbury 20, Conn.
Metal & Thermit Corp.
Rahway, N. J.
Pennsalt Chemicals Corp.
Philadelphia 2, Pa.
The Plating Products Co., Inc.
Newark 2, N. J.
Reynolds Chemicals Products Co.
Ann Arbor 2, Mich.

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E. I. Du Pont De Nemours & Co.
Ceramic Products Div.
Wilmington 98, Del.
Ferro Corp.
Cleveland 5, Ohio
The O. Hommel Co.
Pittsburgh, Pa.
Pemco Corp.
Baltimore 24, Md.
Vitro Mfg. Co.
Pittsburgh 14, Pa.

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Circo Equipment Co.
Clark (Rahway), N. J.
Detrex Chemical Industries, Inc.
Detroit 32, Michigan
The Narda Ultrasonics Corp.
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News Products and People

Las Vegas Going After Country's Big Conventions

Completion of a new, $6 million convention center in Las Vegas, capable of seating 8500 persons, puts that city in the running for major meetings. The city already has 15,000 hotel and motel rooms for visitors.

The center's gleaming 312-foot-diameter aluminum dome can be seen for miles across the Nevada desert. It covers a circular assembly hall 240 feet in diameter and an outer display concourse. Flanking the dome-covered structure are wings housing exhibit halls, meeting rooms and kitchens. Over-all length of the building is 1000 feet, and it contains 275,285 square feet of space.

Aluminum was selected as a roofing material for the dome because of its clean appearance, because it is maintenance-free and because it reflects [illegible] of the sun's radiant heat, thereby keeping air conditioning costs at a minimum. A false ceiling beneath the dome makes the hall almost acoustically perfect.

A 20-foot high by 125-foot wide partition between the exhibit hall and the assembly hall is made of automatically moveable aluminum partitions. They can be closed to provide a sound barrier between the two areas.

Adrian Wilson and Associates, Los Angeles architects, designed the [illegible] with the aid of engineers from [illegible] Steel Corp., Ltd., Los Angeles, the erectors, and Reynolds Metals Co., who supplied the aluminum.

AAR Okays First Welded All-Aluminum Hopper Cars

The world's first welded all-aluminum railroad hopper cars which entered service for the first time two years ago carrying bauxite for Aluminium Limited, have been conditionally approved by the Association of American Railroads for immediatae interchange service on railroads in the U. S., Canada, and Mexico.

Eight tons lighter than steel cars and having a high payload to deadload ratio of more than five to one, the Roberval and Saguenay Railway Co. of Canada currently is using 30 of the cars in heavy duty hauling operations.

As a result of a significant advance in Limited's development of a special aluminum alloy and high speed welding techniques a series of exhaustive fatigue and collision tests demonstrated that the new aluminum cars can be designed to stand up as well as steel under dynamic loading.

The Roberval and Saguenay car series (No. 1300) was Aluminium's first attempt at designing and building welded aluminum hopper cars with steel underframes. After these cars were produced, an aluminum center sill, designed to meet the requirements of the A.A.R., was produced. Sixteen welded aluminum covered hopper cars for bauxite hauling in Jamaica were built in 1956 using the welded center sill.

Pointing out the economical advantages of aluminum car construction, Aluminium called attention to the fact that on the 1.3 degree ruling grade at the company's Arvida smelter it is possible to haul eleven 70-ton capacity cars

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So thoroughly proved are these CLEPO compounds that we are inclined to issue a warning: don't attempt to anodize aluminum *without* using CLEPO-made formulations for preparing your aluminum parts for this treatment. For CLEPO compounds will definitely:

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- remove buffing compounds without tarnishing the highest polish on the aluminum
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- remove smut after etching without fuming or hot acid
- remove smut from silicon-base alloys without hydrofluoric acid
- remove anodize coatings from rejects or racks without hot solutions

These are six outstanding CLEPO compounds useful in the field of anodizing, each formulated to do certain jobs best.

If your production involves anodizing, phone or write to have a CLEPO Field Service man call to demonstrate the benefits CLEPO compounds can bring you. Or if you have some particular steps that are bothering you and want a quick answer, send us the details. We'll be glad to make recommendations and send you a trial sample.

'REDERICK GUMM *Chemical Company Inc.*

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cars with almost 1,034 tons total trailing load of which 770 tons are payload. Alternatively, it is possible to haul eleven aluminum cars which will give about 1,056 tons trailing load, of which 880 tons are payload. Both operations are carried out with the same power, crew time and fuel consumption.

On the basis of its 2-million ton operation, the R & S Railway requires 28,570 carloads if the bauxite is carried in standard steel cars, or a proportionately reduced figure of 25,000 carloads if carried in aluminum cars. This means 2,600 trainloads in steel cars or 2,270 trainloads in aluminum cars. Thus, Aluminium Limited estimates that if all trains consist of aluminum cars, a saving of 330 trainloads is effected in moving 2 million tons.

Aluminum Widely Used In Swim Pool Equipment

Aluminum and aluminum alloys are playing an increasingly important role in the swimming pool industry, according to William O. Baker, president of Swimquip, Inc., manufacturer of swimming pool equipment.

A large percentage of the more than 1700 different items manufactured by Swimquip's plants — at 3301 Gilman

Road, El Monte, Calif., and 1040 Huff Road, N. W., Atlanta, Ga., are constructed totally or partially of aluminum, and the number of aluminum products is increasing.

Swimquip supplies thousands of swimming pool contractors throughout the world. They like aluminum equipment because it is easier and quicker to install, Baker declared.

Residential swimming pools are a burgeoning business. Over 75,000 private pools will be installed in back yards during 1959. Swimquip makes anodized aluminum deck equipment a variety of long-lasting colors to co plement the desired landscaping eff

Swimquip also features "Aquachron aluminum, a thermal epoxy coati which gives the appearance of chro plated brass and is impervious to che cals commonly used in swimming p water.

Magnesium Meetings Next Month in New York

This year the Magnesium Associati will feature nine speakers at its ann convention in the Roosevelt Hotel New York, October 19th and 20th. T theme of the convention is "Magnesi Technology and Trends . . . A Proj tion and Review." The Association's members will exhibit component pa and finished magnesium products consumer, industrial, and military ap cations.

The speakers will discuss devel ments of the new high strength, h temperature magnesium alloys; mark and uses; forging; aircraft parts; stre forming; corrosive environments; jo ing problems; and some case hist studies. The Magnesium Association, East 42nd St., New York 17, invi business men, engineers, and design to its two day convention. No charg

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nder-Eave Vent ew Building Product

A new continuous undereave vent has en announced by Reynolds Aluminum pply Co., Atlanta, Ga. manufacturer Colorweld baked enameled alumi- m. Formed in 8 and 12 foot lengths m .025" Colorweld, the vent fits an ening 2½ inches wide and is per- ated, primed and ready for painting. The vent has been tested on homes the $20,000 to $40,000 price range in lanta, proving simpler and less costly install than conventional screen re. "Improvement in finished appear- ce is immediately noticeable to the me-owner," the manufacturer said. The new vent is now in full produc- n and has been placed on the market oughout Reynolds Aluminum Supply 's system of ten southern warehouses.

luminum Business Growing t Bridgeport Brass

Sales by Bridgeport Brass Co. of alumi- m sheet, strip, rod and tube, forgings d extrusions now account for more an 20% of company business, accord- g to Miles F. Thompson, sales manag- of aluminum mill products.

"With continued expansion of our oduction facilities and research ac- ities, we expect continued improve- nt in this figure," Thompson said. Bridgeport's penetration of the coated il market continues to grow, Thomp- n indicated, reporting that a "number window screen and screen door anufacturers have completed produc- n of initial stocks of their products pastel colors, using Bridgeport's inted aluminum strip.

The strip, produced in Bridgeport's verside, Calif., plant, and painted at verside and in the company's Fleming- n, N. J. plant, is now available in blue, n, pink, green, neutral, white, gold d yellow.

BEFORE
Open seam rolled steel case with three welded lug hinges.
AFTER
Notching of double channel extrusion at left produces strong, seamless hinge section.

Notched Extrusion Produces Better Binder Hinge

FOR WILSON JONES COMPANY

ALUMINUM EXTRUSIONEERING Helps Solve Design Problems

Even though your product is far removed from office binders, this example of P-E Aluminum Extrusioneering for Wilson Jones Company (leading manufacturer of loose-leaf record binders and equipment) may suggest ways to improve your product and cut costs. For years, sectional post cases had been built of fabric-covered, rolled steel sections with welded hinge lugs. As illustrated, slotting a seamless, double channel extrusion now provides a stronger post section which, with a mounting section, produces a more durable continuous hinge.

Extrusion Method Provides Greater Strength, Reduced Weight

Advantages over the former steel case with welded hinges include greater natural beauty, long-lasting aluminum finish, simplified fabricating, and greater hinge strength in less weight. Perhaps P-E Extrusioneering and our non-competitive mill service can help you. Simply send a blueprint or rough sketch for quotation or suggestions. Over 5,000 standard shapes are available without die charge.

WRITE FOR FREE CASE STUDIES—New bulletin "P-E Extrusioneering News" illustrates cost-cutting solutions to various design problems, gives helpful technical and fabricating data.

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Geodesic Dome Big Attraction at Moscow Fair

A gold anodized dome houses part of the American National Exhibition in Sokolniki Park in Moscow, scene of Russia's cultural and industrial fair. Developed by Kaiser Aluminum engineers, who used geodesic principles of R. Buckminster Fuller, the 200-ft. diameter, 130-ft. high structure was assembled and raised in two weeks amidst widespread Russian interest.

Aluminum sheet for the dome was fabricated at Kaiser's Trentwood, Wash., rolling mill and shipped to Lydick Roofing Co., Fort Worth, Texas. The panels were then given the gold anodizing treatment and a spray coating by Universal Products of Dallas, under contract to Lydick, to protect the parts during shipment and erection.

To conserve space, the unformed panels were shipped flat to Mosco Upon arrival in mid-March, the d mond shapes were to have been form on a Russian brake-press. None w available at that time, however, so American brake-press from the Broc lyn Navy Yard was used with Russi crews supplied by the All-Union Cha ber of Commerce.

The dome weighs only 104,0 pounds. The diamond panels ran from 11½ feet long and 7 feet wic weighing 65 pounds, down to 9 feet l 5½ feet, weighing 41 pounds. There a 14 different sizes of panels in all.

Mrs. Llewellyn Thompson, wife the U.S. Ambassador to the Sovi Union, officiated at dedication cer monies, and on one occasion Premi Nikita S. Krushchev toured the site.

DuPont To Build Metals Research Center

A fully equipped metallurgical research center will be constructed at the Du Pont Co.'s Baltimore plant.

The installation will contain equipment to forge, extrude, roll, draw, and heat treat such refractory metals as niobium, tantalum, titanium, zirconium, tungsten, and chromium. It will be capable of producing mill products — ingots, tubes, rod, sheet, strip, and foil for sales development programs.

The facility will be housed at the Du Pont plant in the Curtis Bay section of Baltimore where, since 1931, the company has manufactured titanium dioxide white pigment.

"Rapid advances in new and revolutionary technology in industry, power generation, transportation and communications, both civilian and military, have created a demand for new metals with outstanding physical properties F. H. Weismuller, Pigments Departme manager, said. "Designers of rockets ar jet engines, for example, are severe limited today by the physical properti of conventional structural metals.

"To design more efficiently," Wei muller continued, "we need structur metals that will withstand temperatur well above 2,000° F., that have a lo neutron absorption, and that will ope ate without impairment in highly co rosive conditions. There are know metals and alloys with unique hig temperature strength, corrosion resis ance, and nuclear properties. But ma of them are not yet commercially ava able.

"These are the refractory, or hig melting metals like niobium. They a won from complex ores by chemic

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On Alcoa Theatre (NBC-TV Network, alternate Mondays, 9:30 p.m., EDT) . . . two hard-hitting commercials, each going home to 25,000,000 viewers with aluminum's easy-working, hard-wearing hardware story.

On Alcoa Presents (ABC-TV Network, every Tuesday, 0:00 p.m., EDT) . . . six more hardware commercials, resented on one of the nation's most dramatic television series to a skyrocketing audience of more than 0,000,000.

On Network Radio . . . reaching an estimated 3,000,000 steners with multiple sales messages on aluminum ardware.

"MARKET-MAKER" symolizes Aluminum Company of merica's year-round salesimulating programs for manuacturers and retailers of aluinum products. Watch for her "Market-Maker" promoons of FURNITURE • OOKWARE • GIFTWARES BOATS, MOTORS AND CCESSORIES • SPORTING OODS • MAJOR APPLINCES • RESIDENTIAL UILDING PRODUCTS

Make it pay! Tie in with Alcoa's sales-making theme: "BUY EASY-WORKING, HARD-WEARING ALUMINUM HARDWARE!" . . . feature it in your own advertising and promotions.

8 OUT OF 10 BUYERS KNOW THIS LABEL... IT'S THE BRAND BEHIND THE BRANDS THEY BUY

ALCOA ALUMINUM

Your Guide to the Best in Aluminum Value

Manufacturers of aluminum hardware products are invited to write us or contact the nearest Alcoa sales office for details on the simple agreement that entitles them to full labeling privileges.

Aluminum Company of America
1600-J Alcoa Building, Pittsburgh 19, Pa.

methods of extraction and purification rather than by standard pyrometallurgical methods of smelting and slag refining. Properly alloyed, the new metals will solve many of the critical design problems in rockets and missiles, gas turbine engines, atomic power generators, and other 'space-age' hardware."

Niobium alloys will also be important in obtaining improved high temperature performance from equipment used in the chemical and petroleum industries, metallurgical operations, and in power generation.

Economical, Long Lasting Drapery "Fabric"

A new drapery material made of tightly woven aluminum reeds has been introduced by Eastern Products Corp., Baltimore, Md., a leading manufacturer of venetian blinds and drapery hardware.

"Easternweave" is expected to cost less than conventional drapery fabrics, yet will last indefinitely because it is weatherproof and fireproof.

Initially, four decorator colors will be produced — green, gray, fawn tweed and white. A variety of other fabric designs and colors will be produced soon.

The tweed fabric designs and colors are printed over a tough enamel baked on the reeds which are double embossed for strength and texture.

"Easternweave can be cut with ordinary scissors and sewn with a regular needle," said Harry Rosenbaum, president of Eastern Products.

Rosenbaum said that his company is using Easternweave to make a new se-

ries of roll-up shades and folding doo
the first aluminum fabric shades
signed both for indoor and outdoor u
They are made in six- and seven-f
lengths, in widths from two feet, eig
inches to nine feet. Soon they will
made in 12-foot lengths and in bu
rolls for drapery makers.

The weatherproof feature means th
Easternweave porch shades can be l
outdoors all year, thus eliminating
chore of taking them down or putti
them up every fall and spring.

"Doors, shades and drapes made
Easternweave can be trimmed to fit a
size opening, operate smoothly and ne
only an occasional flick of a dust cl
to keep them clean," Rosenbaum sa

The material is fashioned of ⅜-in
wide aluminum reeds which are wov
together with mildew-proof threads.

GRIND
POLISH
BUFF
DEBURR

WITH A Hammond STRAIT LINE AUTOMATIC

Over and Under Strait-Line shown. Other Strait-Lines available in Reversing, Horizontal Return and Open Center types.

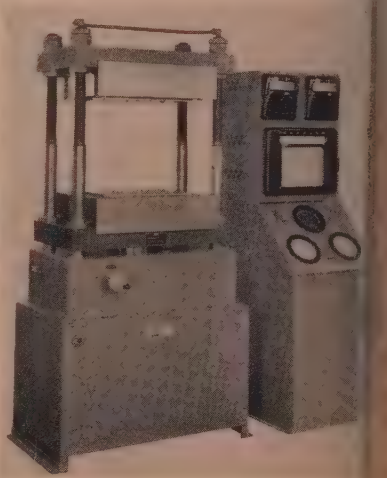
Head styles include floating, non-floating and oscillating with 1-1/2 to 25 HP range.

Hammond Automatics will speed your grinding, polishing, buffing, brushing and deburring operations.

Send Samples . . .
and we'll show you how much you can speed production and cut costs.

Hammond Machinery Builders INC.

1609 DOUGLAS AVE. KALAMAZOO, MICHIGAN



Hot Platen Press Serves New Manufacturing Need

A hydraulic hot platen press with co
trolled temperatures up to 1500°F is
built by Pasadena Hydraulics, Inc., El
Monte, Calif. The builder said the ne
design answers a need created by ne

terials such as powdered metals that quire compressing with a bonding ent.

'Another application would be holdg and heating preformed metal parts precise configuration and dimension hich under any other condition would tort sufficiently to cause rejection," company spokesman said.

The new press was conceived when HI was invited to bid on the construcn of a hydraulic press capable of susned platen temperatures to 1500°F, e platens to be individually controlled d temperatures accurately recorded. he hydraulic system had to include riable closing and pressure speeds to 0,000 pounds.

'We designed, built and delivered this ess which conformed to all the cusner's requirements," reported C. Roy llord, PHI president. "The press me is so well insulated that it pracally remains stone cold while the tens are at a bright orange glow." The hydraulic system includes varia- closing and pressing speeds, large ssure gauges to permit accurate read-, in low, intermediate and high ges. Platen sizes can range from eight 24 inches square; tonnage from 40,000 1,000,000 pounds for ram force.

Specifications of the PHI 1500° F ess: Capacity, 50 ton ram force; stroke, inches; daylight, six to 18 inches; rall height, 80 inches; width, 39 hes (press), 22 inches (console); gth, front to back, 27½ inches con- base; weight 3300 pounds.

ynolds Installing w Annealing Furnaces

unbeam Equipment Corp., Meade, Pa., has started erection of ten minum coil annealing furnaces for Reynolds Metals Co. alloys plant r Sheffield Ala. Photo shows proto- furnace that was built and tested Sunbeam's Meadville, Pa. plant. en loaded to capacity the furnace accommodate 150,000 lbs. of alumi- n coil.

Kaiser Adds to Building Panel Line

Increased consumer demand for precolored building materials has caused Kaiser Aluminum & Chemical Corp. to introduce a line of green-colored aluminum building panels.

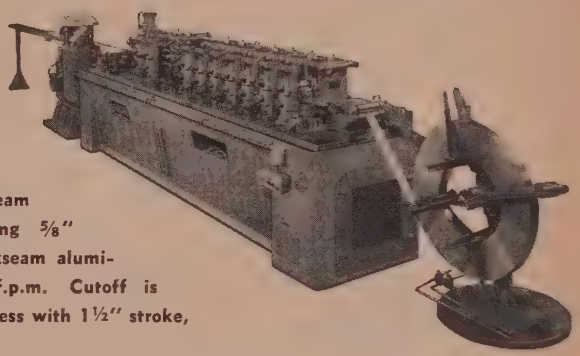
Called green Diamond-Rib, the product is a low cost material for residential sidewall panels, roofs, patios, carports, decorative fences, interior wall covering, summer cottages and boat shelters, in addition to having numerous light commercial and farm applications.

The sheets are embossed with a diamond pattern and have flat-top rib configurations giving pleasing shadow lines and added strength. The color, a neutral light green, is achieved by a special chemical bonding process. If painting is desired, the chemically treated surface serves as an excellent paint base. One finish coat, brushed or sprayed on, is sufficient, Kaiser said.

The width of each panel is 50-1/3 inches providing a full 48-inch coverage after lapping. Lengths are 8, 10, 12, 14 and 16 feet.

Kaiser Aluminum's first colored aluminum building sheet available to consumers as a standard item is the latest addition to a family of Diamond-Rib building materials.

AMERICAN ROLLER DIE CORP.
ARDCOR HIGH PRODUCTION ROLL FORMING MACHINE FOR ALUMINUM SHAPES



This Model SF Lock Seam Tube Mill is forming 5/8" O.D., .016" wall lockseam aluminum tube at 120 f.p.m. Cutoff is ARDCOR Model 10 Press with 1½" stroke, 60 strokes per min.

The new small Model SF ARDCOR Machine features: High production speeds; spindles 1.5"; new style rugged base with tool compartment and slanted front recessed for better operator stance; special narrow side roll stands with close 10" horizontal centers; fixed spur gears; quiet running all V-belt drive; low voltage protection. Basic machine readily converted to a Cold Roll Forming Machine.

ARDCOR Roll Forming Machines and Lock Seam Tube Mills are available in seven standard sizes; other sizes to customer specifications.

If your products can be cold roll formed, ARDCOR engineers can supply advancements in design and machine construction to produce them better . . . at greater speeds and profit.

Consult our Engineering Facilities without obligation . . .

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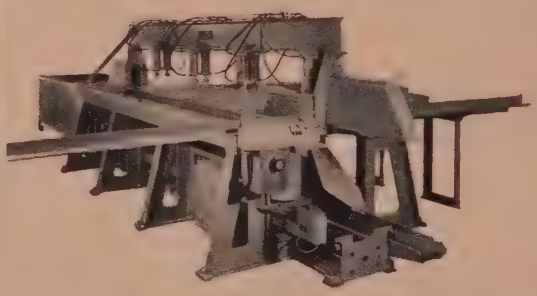
for precision cutting of plates and sheets of all sizes up to 6" thick



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For cutting aluminum, bronze, micarta, copper and other nonferrous metals . . . adaptable to individual requirements, yet provides economy of operation . . . satisfies rigid demand for accurate work and fast cutting. Send for illustrated folder giving full details.

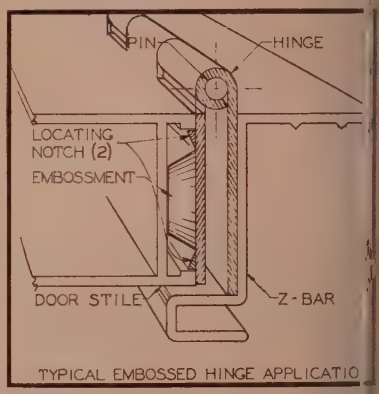
OLIVER MACHINERY COMPANY
GRAND RAPIDS 2, MICHIGAN

Bearing Aluminum Bars Make Debut

New bearing aluminum bars for ... dustry's use in original installations a... in maintenance are being made for t... first time by Bunting Brass & Bro... Co., Toledo, Ohio. Cast aluminum be... ings have been in use for a number ... years, according to William M. H... kins, Jr., president of Bunting, ... never has there been a supply of be... ing aluminum bars which can be m... chined to meet any bearing need.

The company's line of bars will ... made of Alcoa B-t50-T5 alloy which c... tains copper, nickel and magnesiu... Hankins said the bars make good sle... bearing material because they h... good heat conductivity, excellent c... bedability, good ductility, high l... carrying capacity, high resistance to c... rosion, conformability to the shaft a... good fatigue strength.

The new bearing aluminum bar l... supplements Bunting's original line ... cast bronze bars, bushings and beari... and special parts. Hankins said that ... new line will find widespread use ... new industries.



TYPICAL EMBOSSED HINGE APPLICATIO

Hardware Manufacturer Adds To Hinge Line

A new hinge design has been ad... to the line of hardware made by L... Park Metal Stampings, Inc., Box 30... Youngstown, Ohio.

As shown in the drawing, the hi... leaf mounted on the door stile, is e... bossed to bridge gap on door edge ... serve to support screws. This lea... also furnished with guide slots to h... installer in aligning hinge.

Lake Park's continuous alumin... embossed hinge has leaves of unec... widths. The narrower, embossed ... is applied to door stile, while the wi... leaf is mounted on Z-Bar. The wi... of this wider leaf is such that a nat... seat against the stop of the Z-Ba... attained, in addition to automa... clearance for the door stile.

Standard lengths are 81, 84, 87 90 and 96 inches, with over-all width of 2 and 2-3/16 inches.

KAISER ALUMINUM

ALUMINEWS

A page of products and availabilities for those interested in metalworking. If you would like detailed literature on each subject, mail the coupon below.

Bright finish welding wire

ow a new type of *bright* welding wire · MIG and TIG welding processes is ailable for high strength welding... iiser Aluminum's King* brand weld- ; wire.

It's available in a complete line of ·lding rods and electrodes in a broad ıge of alloys—including new all-pur- se alloy 5183, developed specifically welding the high strength mag- sium-bearing aluminum alloys 5083 d 5086.

The consistent high quality of King and bright finish welding electrodes d rods is achieved by rigid produc- n and inspection controls, including diographic and destructive testing of tual welds.

aiser *IN*ert *Gas*

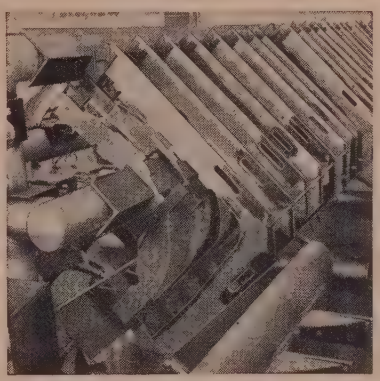
Wider sheet, heavier plate

ıe production of wider sheet, heavier ate and bigger coils is made possible Kaiser Aluminum's 168-inch, 4-hi reversing hot mill and 100-inch, 5-stand continuous mill at Ravenswood, W. Va.

Sheet and plate in width to a maximum of 144 inches and finished coils weighing up to 8500 pounds are included within final availabilities. Foil in gauges as light as 0.00025 inches and widths to 66 inches is also in production.

mt 10,000 lb. aluminum ingot being lifted from ect chill casting station at Kaiser Aluminum's venswood plant. Next stop—the hot line!

3. *Rolled tooling plate*



A typical large aircraft assembly fixture. Use of aluminum tooling plate provides greater portability and simpler set-up without need for overhead cranes or lift trucks.

Produced for today's tool design requirements, Kaiser Aluminum's Rolled Tooling Plate opens up exciting new avenues to cost cutting.

Reasons: (1) It's machined both sides to provide a flat base for accurate layout and measuring; (2) it offers a finer grain structure, freedom from porosity, higher strength, finer finish and better welding characteristics; (3) it weighs only one-third as much as steel, handles easily without the need for expensive positioning equipment.

Among the growing list of industries profiting from Kaiser Aluminum Tooling Plate: aircraft, electronics, appliance, automotive, plastics, foundry and marine.

4. *High strength yet ductile casting alloys*

Now, by using one of Kaiser Aluminum's high purity casting alloys—X357, A356 or C355—permanent mold and sand castings can be designed and produced to be competitive with more expensive fabricated products including forgings.

By holding iron and other impurities to a minimum, and with Kaiser Aluminum's close metallurgical production control, these superior casting alloys permit high temperature artificial aging to develop full strength potential without brittleness.

For example—castings made of our high purity alloys, can be produced with increased tensile and yield strengths or redesigned to have the same strength characteristics with significant weight reductions.

KAISER ALUMINUM

THE BRIGHT STAR OF METALS

Please send me detailed literature on the subject circled below:

1. Bright Finish Welding Wire
2. Sheet And Plate
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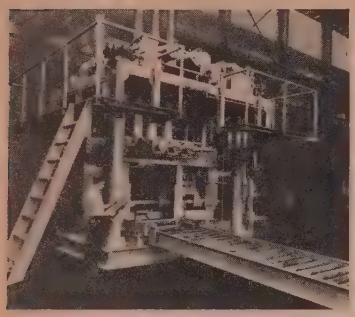
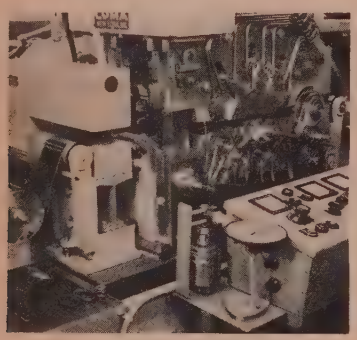


CONTINUOUS CASTING MACHINES

CIRCULAR SAWING MACHINES



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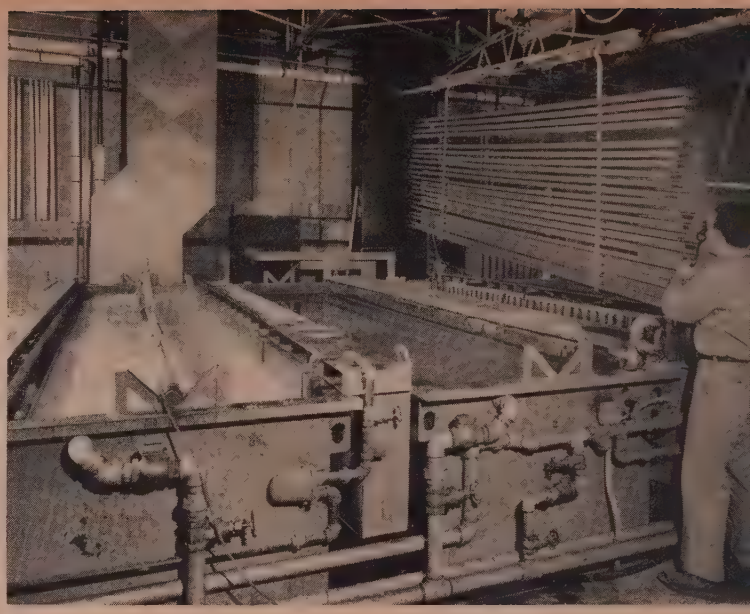

U. S. Extrusions Opens Anodizing Plant

Another extruder has installed a complete anodizing operation. United States Extrusions Corp. of Garden City Park, Long Island, New York, has completed what it calls an automatically controlled anodizing plant. The company is anodizing aluminum in lengths up to 18 feet and plans to process about 400,000 pounds per month in the new plant. The operation uses a sulphuric acid bath, and shapes are being anodized either clear or etched.

The operation, which cost $15 meets U. S. government specific and is equipped with all automati perature and solution time cycle trols. According to Emil Buckner, dent, U. S. Extrusions is the extruder presently anodizing in New York metropolitan area. The pany will process extrusions for customers in the New York area.

Extruded Aluminum Shoring Device Is Faster, Safer

Saf-T-Jax is a new trench shoring device which permits faster and safer trench shoring on pipeline, sewer and other excavation jobs.

The strong, integrally operated unit consists of two opposing aluminum shoring members which are separated and supported by hydraulic jacks.

The complete units weigh less than most wood shoring timbers and are designed so that one workman standing at the top of the trench can easily install them directly behind the digger.

Saf-T-Jax is also retracted from the top of the trench and folds together into units only 5¼ inches thick for handling and storage.

Two models, a unit with 2½-foot long shoring pads and a seven-foot unit, are available. Both are equipped with eight-inch wide extruded aluminum alloy shoring members supplied by Kaiser Aluminum.

The pads, which have a strength equal to first grade 2 x 8 timbers, are connected by hydraulic cylinders which will brace trenches 20 to 28 inches wide. When extension rods are used, ditches as wide as 70 inches can be shored

with no loss of safety features. C ders are connected to the shoring by hinges for folding.

A portable pump is used to s pressure to the two hydraulic jack

ineable Aluminum Alloy Makes Better Back-Up Bars

Reynolds Metals Co. missile
t Sheffield, Ala. has discovered
nachineable aluminum alloy can
ned into back-up bars that are
r to stainless in the metal inert
welding of aluminum.
new back-up bar has an easily
able T-shaped stainless steel in-
reviously the bars were all-stain-

les M. Jenkins, production sup-
dent at the missile ballistic shell
nd leader in the development of
v back-up bars, said they offered
jor advantages over conventional
less bars.
is that the aluminum bar dis-
the welding heat much quicker
ne stainless type, obviating the
or water jackets in use on some
ion stake welders. Faster heat
ion keeps weldment distortion
inimum.
other advantage is that the stain-
el inserts are cheap enough to
arded after their grooves become
and pitted. They can be re-
for less than half the average
repairing the all-stainless back-
.
uction is also speeded, according

to plant manager M. C. Duke, because inserts of different groove sizes for different sheet thicknesses can be put in much more quickly than was the case when the entire back-up bar had to be switched.

After using the new back-up bars a year, Reynolds has not found it necessary to replace any of the aluminum bars which hold the stainless steel inserts. Bars and inserts both can be produced by extruding or machining, plant officials said.

Chemical Polish Process

A new chemical polishing process which levels and brightens the surface of aluminum-silicon alloy castings, called Luster Burr, has been introduced by Alchemize Corp., 625 South Kolmar Ave., Chicago 24.

The process, said to brighten aluminum in 10 to 90 seconds at room temperature, should be useful for applications prior to anodizing, electroplating, conversion coating, etc.

New Chromate Coating

A new amorphous chromate coating for aluminum, called Alodine 1200S, is being manufactured by Amchem Products, Inc., Ambler, Pa. It is said to answer the problem of uniform quality in providing corrosion protection and paint bonding for aluminum.

This coating is 50% faster for processing than previous Alodine coatings, according to Amchem, and gives more uniformity and a higher grade coat.

Alodine 1200S is recommended for use in high production baths such as strip lines. It can be processed through a continuous dip which should reduce initial equipment costs and maintenance.

tention: Makers of Aluminum Products

A Complete Porcelain Enameling-On-Aluminum Service*

ic coating

Are you in need of an economical source of porcelain enameling of aluminum or aluminized steel? We have complete facilities for prompt, economical porcelain enameling of many sizes of aluminum panels and other relatively flat aluminum shapes that have been rolled, extruded, spun or cast. These include flat extruded panels, flat shapes for appliances, flat sheets and shapes for signs, and many types of aluminum extrusions for sundry purposes.

Vikon pioneered porcelain enameling on aluminum, and continually conducts experimental and development work on specialty items in our research laboratories. Vikon offers modern, completely automatic facilities and practical technical know-how. We would be pleased to discuss the suitability and cost of applying porcelain enamel and/or alodine to your aluminum products. Write, wire or phone today.

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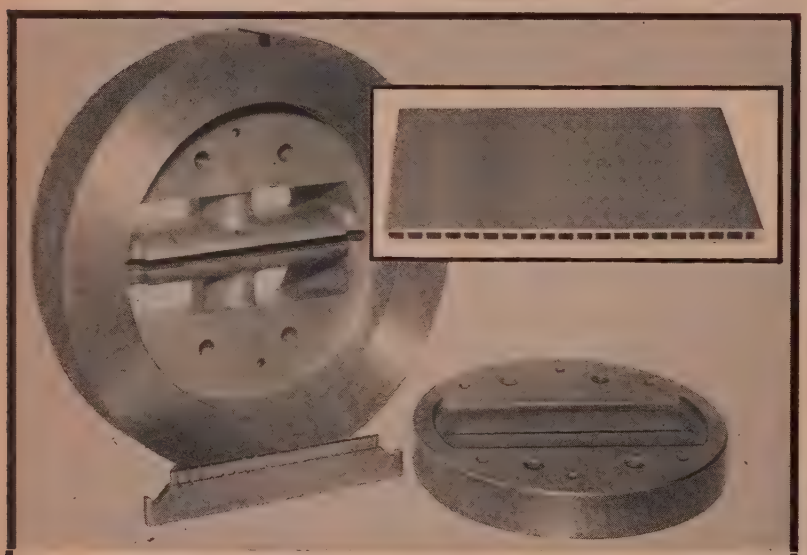

extrusion dies by mardis!

Shown above: Original MARDIS-designed, liquid passage, 20-mandrel dies used to extrude the 10¼" extrusion (see inset) from a 9" billet! All MARDIS dies are expertly machined to exceptionally close tolerances. Let MARDIS solve **your** next extrusion problem.

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Looking Ahead

The steel and copper strikes are about over — October 10th is our estimate — and aluminum has certainly cashed in on added sales during the strike period. So producers' earnings should be good in the third quarter. It was smart footwork for the industry to agree to settle after steel because during the strike there was a lot of "trying aluminum" for replacing steel and copper. Many will stick with aluminum after things return to normal.

The big Canadian producer, Aluminium Limited, sees more demand for its aluminum throughout the world; is now reactivating 33,000 tons of annual capacity. Present rate is 500,000 tons, with 220,000 tons still idle. In this country, the six aluminum producers are currently operating at slightly over 90% of capacity.

World production and use of aluminum continues to move up. Total production last year amounted to 3.8 million tons, vs. 3.7 million tons in '57. This year it will top four million tons for the first time. The U. S. leads the pack with about 1.7 million tons; Canada is second with production at 650,000 tons; and Russia is a close third with 600,000 tons. France, West Germany, and Norway follow with 180,000 to 130,000 tons. The remaining 19 aluminum-producing countries are small operations, and growth will be slow. Russia is the ambitious one; hopes to more than double capacity to 1.8 million tons by 1965. By that time the U. S. aluminum industry should have added a million tons of capacity.

Japan's aluminum industry is booming; will make about 105,000 tons this year — still not enough for domestic needs. Biggest demand is for sheet, coil and plate, and the rolling mills have requested import certificates for 4000 tons. Nearly all of the aluminum will be purchased from U. S. and Canadian producers. Japan's use can grow greatly in the next few years. It can also become a huge exporter of low-cost finished aluminum products — most of which could be offered for sale in your favorite neighborhood store.

Since the Russians have hit the moon, it becomes harder to discount any claims they make. Latest is that the new 200,000 ton smelter in Stalingrad produces 34% more aluminum per kilowatt-hour than older plants. This is a tremendous saving, but they fail to say whether it's "over" existing Russian plants or plants throughout the world. Russia currently has three aluminum plants under construction — one is 250,000 tons, another 300,000 tons, and the big job is 400,000 tons. You can hear lots of talk in U. S. aluminum circles that all this aluminum is being built for export, but we disagree. That Russian capitalist who's been visiting us has a serious housing problem on his hands. Our guess is that the building industry is now being educated to use aluminum. Reason: Those Russian architects who toured Europe and the U. S. last summer would listen all night when anyone opened up on aluminum in building and construction.

Lots of talk abroad about magnesium, too. Biggest user in the world, of course, is Volkswagen in Germany. The car's engine alone consumes about 12,000 tons of magnesium castings annually — and next year consumption will be higher. A peculiar twist when you consider that magnesium normally is more expensive than steel or aluminum, and that the Volkswagen is one of the lowest-cost cars built anywhere.

Magnesium plants in Italy, producing up to 6000 tons a year, using low-cost female labor and employing an efficient "buried resistor" electric furnace in the reduction of magnesium from dolomite, are selling magnesium ingot to Germany at under 30 cents a pound. The Norwegian magnesium producer — Norsk Hydro — which is partially owned by the government, is also selling its metal at discount rates to Germany and other countries. This company is currently increasing its capacity by 50% to 13,500 tons annually.

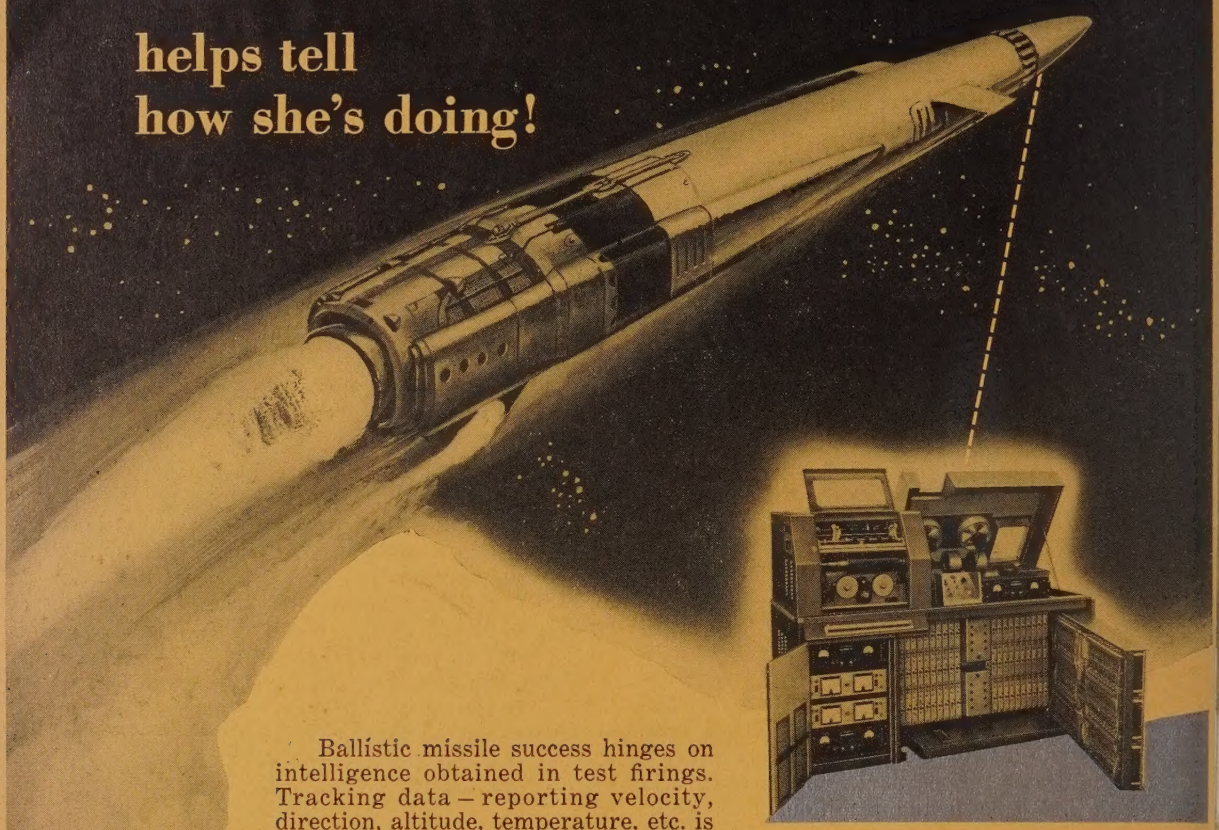
European prices for magnesium will undoubtedly influence future prices here because the U. S. and Canada have both been exporters, and export pricing has been low and irregular. Now that we have a second U. S. producer, lower magnesium prices may be in the offing. Auto makers have been offered special magnesium alloy ingot at 31.5 cents a pound for use in die cast parts for the 1961 models. There is also an added allowance for development costs. This is well below the published price for magnesium ingot and, on a volume basis, is competitive with aluminum and zinc die casting ingot. Thus, magnesium has entered a new era: To compete with other basic materials. This is as it should be.

Cars will use much more aluminum in 1960 than ever before, perhaps up to 500 million pounds. The way Detroit auto men are now talking, you'd almost think that using the metal for the obvious applications was an overnight invention. As we view this revolution in auto row, aluminum came of age in Detroit last month. A television announcer devoted a full commercial to the fact that the sponsor's new anti-freeze won't hurt aluminum if the radiator is made of the stuff. Pretty shrewd.

— The Editors

FRASSE ALUMINUM

helps tell how she's doing!



Ballistic missile success hinges on intelligence obtained in test firings. Tracking data – reporting velocity, direction, altitude, temperature, etc. is vital – when processed, it guides critical design changes.

Heart of the intricate data processing system at Cape Canaveral is a Potter Magnityper – a high speed electronic printer that decodes raw material . . . then stores, collates, interprets and prints at 72 *thousand* characters per minute. Lightweight, non-magnetic aluminum is essential to its efficient operation – that's why the Magnityper is made almost completely of Frasse aluminum.

Frasse ships the required sizes quickly from stock – in the grades that contribute to its ease of fabrication *and* performance. For example, Frasse supplies 2024-T4 bars for *strength* and *machinability*, 5052-H34 sheet for *formability* and *weldability* and "775" tooling plate for *dimensional accuracy* with *no distortion when worked.*

Perhaps these same qualities can increase the efficiency of *your* product – or reduce fabricating costs. It's worth investigating – and a Frasse aluminum specialist will be glad to help. There's no obligation – simply write or call your nearest Frasse office. You'll be glad you did.

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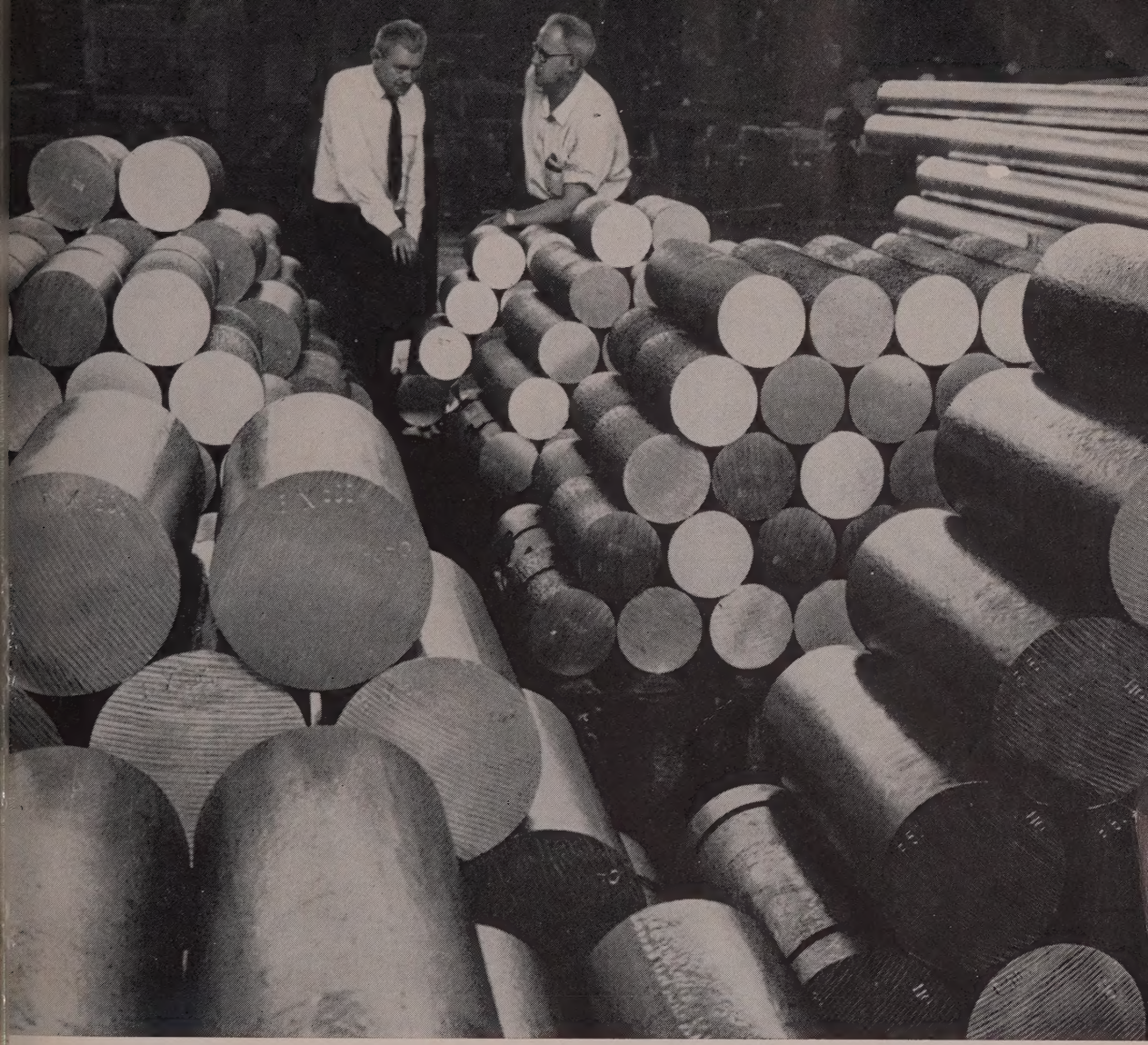

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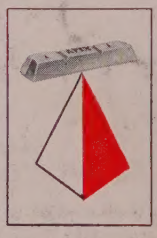

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